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MONTHLY AVERAGE SEA-SURFACE TEMPERA-
TURES AND ICE-PACK LIMITS ON A DEGREE
GLOBAL GRID

R. C. Alexander, et al

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Climatological monthly ocean-surface temperatures
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Monthly distributions of the main ice packs of the
Arctic and Antarctic are digitized from Fleet Weather
Facility ice charts and Navy Atlases and then in-
corporated into the global arrays. Machine-analyzed
maps show the 12 monthly distributions, and maps
and tabulations of averages of these data for the
months of February and August are shown on a global
grid of 4° latitude x 5° longitude.   34 pp.   (JDD)

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December 1974

Monthly Average Sea-Surface Temperatures and Ice-Pack Limits on a 1° Global Grid

R. C. Alexander and R. L. Mobley

A Report prepared for

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

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Rand
SANTA MONICA, CA. 90406

PREFACE

This report was prepared as part of a long-range effort to tabulate pertinent climatological and topographic information for the global atmosphere and ocean in a model-compatible format. The data are used in the work of the Rand/ARPA Climate Dynamics Program, sponsored by the Defense Advanced Research Projects Agency. Related tabulations are those of ocean depths in Rand Report R-1277-ARPA and of terrain heights in R-1276-ARPA. Tabulations of global atmospheric climatic data have been given in R-915-ARPA, R-1029-ARPA, R-1317-ARPA, and R-1425-ARPA.

SUMMARY

Climatological monthly ocean-surface temperatures obtained from the National Center for Atmospheric Research and from Fleet Numerical Weather Central are merged and interpolated onto a 1° global grid. Monthly distributions of the main ice packs of the Arctic and Antarctic are digitized from Fleet Weather Facility ice charts and Navy Atlases, and are incorporated into the global arrays. Machine-analyzed maps of the 12 monthly distributions are presented, together with maps and tabulations of averages of these data on a global grid of 4° latitude × 5° longitude for the months of February and August.

ACKNOWLEDGMENTS

CONTENTS

I. INTRODUCTION

In numerical simulations using atmospheric general circulation models (GCMs) the distributions of sea-surface temperature and sea ice are required as input boundary conditions. When simulation times are comparable to one month or less, it is usually adequate to hold temperature and ice distributions fixed. For longer time scales, as in seasonal and interannual climatic simulations, there is a need for monthly distributions with which to simulate changing boundary conditions at the earth's surface. With the development of oceanic GCMs leading toward climatic experiments with interactive atmosphere/ocean models, there is the additional need for global oceanic data with which to calibrate and test both the ocean models and the coupled models. Generally, such data are available only for selected ocean basins and are not in a model-compatible format.

Recognizing such needs, Washington and Thiel (1970) have presented monthly average ocean-surface temperatures that they digitized on a 2.5° global grid from a composite of sources. Although these data undoubtedly constitute the most complete single source of sea-surface temperatures available, they do not extend into latitudes higher than approximately 60°N and S, and there is an additional need for ice-pack distributions. The purpose of the work described here is to revise and extend the data of Washington and Thiel to the entire globe on a 1° grid, and to include in the tabulations the monthly distributions of the main ice packs. The purpose of the 1° grid is to facilitate application to various GCM grids.

Because a tabulation of 12 monthly distributions on a 1° global grid is too large for convenient publication, we give here global maps of the fine-mesh data, together with tabulations and maps of averages of these data on a mesh of 4° latitude × 5° longitude for the months of February and August. This is done in the belief that these maps and tables may be of interest to the meteorological and oceanographic communities in general. The more complete data on the 1° grid are available on magnetic tape upon request.

I. SOURCES AND METHODS

SEA ICE

For the Arctic we used the monthly ice charts of the U.S. Fleet
Weather Facility (FWF). These charts, which give distributions of ice
greater than 0.5 fractional coverage, are in general agreement with
the Hydrographic Office Atlas (1958) but are less detailed in that they
do not include other fractional coverages. The advantage of the FWF
charts is that they apply to a larger region than that of the Hydro-
graphic Office Atlas, including northern portions of the Pacific,
Atlantic, and Hudson Bay.

The FWF charts give monthly distributions for the months of November
through March and semi-monthly distributions for April through October.
Rather than average the semi-monthly distributions, we chose the ice
charts appropriate to the last half of each of these months as being
sufficiently representative. This introduces a slight bias toward more
open water in the spring and toward more ice in the fall, but has the
advantage that the distributions for the first half of each of these
months can be included later without requiring modification of the
existing data.

For the Antarctic, we used the monthly mean limits of the ice pack
as provided in the Hydrographic Office (1957) charts. These limits
generally correspond to ice coverages greater than 0.5, but also include
some concentrations within the boundary of the main pack that are less
than 0.5. These exceptions occur near the Antarctic coast during the
summer months of December through February.

The ice limits were digitized by hand from the foregoing charts
by means of a piece-wise linear approximation to a continuous line
surrounding the pole. The boundaries of disconnected patches of ice
were also included. Wherever the ice limit intersected the coast, the
line was continued across land by the most direct route to the nearest
coastal point where the ice limit moved out to sea again. From input
coordinates of the ice limits, a computer program assigned ice to those
points on the grid that were completely bounded by the lines. Particular

care had to be given to the complicated summer distributions in the Canadian Arctic. We believe that the results are accurate and realistic when a realistic land distribution is used to suppress land points.

SEA-SURFACE TEMPERATURES

Global monthly sea-surface temperature data were obtained on magnetic tape from the National Center for Atmospheric Research (NCAR), and are as documented by Washington and Thiel (1970). Valid data points were represented by Centigrade temperatures on the NCAR $2.5°$ global grid. Missing data points in latitudes higher than approximately $60°N$ and S, as well as all land points, were designated by 999.

Our first task was to interpolate or extrapolate the NCAR data into land areas and high latitudes in order to facilitate further interpolation onto a $1°$ grid. The Hydrographic Office Atlas (1957) reports that water temperatures beneath the Antarctic ice pack are typically $29°F$ $(-1.7°C)$ throughout the year. Having digitized the monthly ice limits, we assigned a uniform temperature of $-1.7°C$ to all NCAR mesh points lying within areas covered by sea ice, according to month. The remaining points with missing data were filled in by a form of bilinear interpolation, defined as the average of east-west and north-south linear interpolations between the nearest valid data points. The linear interpolations were weighted according to distance from the valid datum. In some instances, only a single interpolation in one direction was possible. Two-dimensional Bessel interpolation was then used (Steffensen, 1950, p. 210) to fill in a $1°$ global mesh, giving temperatures at all intersections of integer latitude and longitude. At this point, however, we did not regard the results north of approximately $60°N$ as being valid. A better representation was needed for the Arctic and adjacent seas.

The second major source of monthly sea-surface temperatures was the northern-hemisphere climatological data that we obtained, also on magnetic tape, from U.S. Fleet Numerical Weather Central (FNWC). These data, in current use by FNWC as of late 1972, were defined on the Navy grid, which is a 125×125 rectangular grid superimposed on a polar sterographic projection, true at $60°N$. The equator is an inscribed circle, meaning that the rectangular mesh extends somewhat south of

the equator in the vicinity of four meridians. These meridians are at 125°W, 35°W, 55°E, and 145°E, where grid points extend to approximately 16°S. Values had already been interpolated onto land points by FNWC, so no further interpolation of this type was required. Again, Bessel interpolation was used to transform the data onto the 1° grid.

A decision was required at this stage concerning where to merge the two sets of data: (a) in high northern latitudes where the NCAR data are missing or (b) near the equator and low southern latitudes where the FNWC data terminate. There are other possible approaches, but we chose (b) because the FNWC data appeared to give better resolution of the cold equatorial region in the eastern Pacific in January and February. The method of merging employed weighted averages of the NCAR and FNWC data within a 10° latitude belt bounded to the south by the limits of the Navy grid. The weighting was linear with latitude. As a final step, we applied a nine-point smoothing operator (Shapiro, 1970) to the resulting 12 global arrays to remove a small amount of noise introduced by the interpolation and merging procedures.

III. RESULTS

By the methods described in Sec. II we obtained 12 monthly 181 × 360 arrays with temperatures stored at every integer value of lati- tude and longitude. Temperatures for water that is covered by ice are given in degrees Kelvin, for which we have used the transformation $273.1°K = 0.0°C$. The remainder are in degrees Centigrade. This was merely a convenient way to distinguish ice-covered water from open water in our data. As described in Sec. II, the ice-pack distributions cross land in the basic data files, but the results are found to be realistic when land points are masked out by a realistic land distribu- tion. Machine-analyzed maps of the 1° mesh data are given in Figs. 1 through 12, in which ice-pack distributions are designated by broken hash marks. The land outlines are based on the data of Smith et al. (1966), as corrected and interpolated onto a 1° global mesh by Gates and Nelson (1973). Gall's stereographic projection (Bartholomew, 1966), which is true at 45°N and S, was used for the figures.

Concerning resolution, we emphasize that use of a 1° global mesh is for convenience in interpolating onto various other grids. No accuracy greater than that implied by the NCAR 2.5° global mesh, or the FNWC 125 × 125 mesh, can be claimed for the temperature data pre- sented here. However, we believe that the accuracy of the main ice-pack distributions is consistent with that implied by a 1° mesh.

The 1° mesh data have been area-averaged onto the 46 × 72 global grid (4° latitude, 5° longitude) that is currently used in general circulation modeling at The Rand Corporation, UCLA, and the Goddard Institute for Space Studies. The results for the months of February and August are given in Figs. 13 and 14, and in Tables 1 and 2. The land distributions of Figs. 13 and 14, which correspond to the asterisks of Tables 1 and 2, were objectively determined from the 1° data of Gates and Nelson (1973). This is the land outline in current use with the Rand atmospheric GCM.

IV. RECOMMENDED FUTURE OCEANIC DATA ACQUISITIONS

As oceanic GCMs become more sophisticated, e.g., have increased resolution or include ice-pack models, there will be increasing requirements for more detailed oceanic data in a model-compatible format. Some suggested categories for needed improvements are described below.

SEA ICE

A high-priority item in this category is to include the remaining semi-monthly distributions for the months of April through October in the Arctic. This would give an improved representation of the more rapidly changing ice distributions that occur in the warmer months. Similar details should be added for the Antarctic when available. In addition, more detailed fractional coverages of ice (e.g., <0.1, 0.1 to 0.5, and so forth) will probably be required. The degree of coverage and the presence or absence of openings and leads are important in computing atmosphere/ocean heat transfer.

SEA-SURFACE TEMPERATURES

Anticipating the need for increased horizontal resolution of global ocean models, we will want to add more detailed temperature distributions consistent with 1°-mesh accuracy. An example is the monthly distributions of sea-surface temperature for the eastern Pacific compiled by Wyrtki (1964).

Measurements of sea-surface temperature by earth satellite represent a promising way to obtain global synoptic data. As methods are developed for increasing the accuracy of these measurements and filtering out the effects of cloud cover, the addition of such data to a digitized climatological data base should be valuable, particularly in sparse-data areas.

TEMPERATURE AND SALINITY WITH DEPTH

A compilation of global sea-surface temperatures is only a beginning task in the process of building an adequate climatological data base

for the global ocean. The density and freezing point of sea water depend on salinity as well as temperature. Perhaps the highest priority in future work should be given to obtaining at least seasonal averages of the global distributions of both temperature and salinity at standard depths for the upper ocean, say, the upper 200 to 300 m. Much of the required raw data are available from the National Oceanographic Data Center (NODC, 1969), but these will have to be analyzed, and there are appreciable areas in which data are sparse.
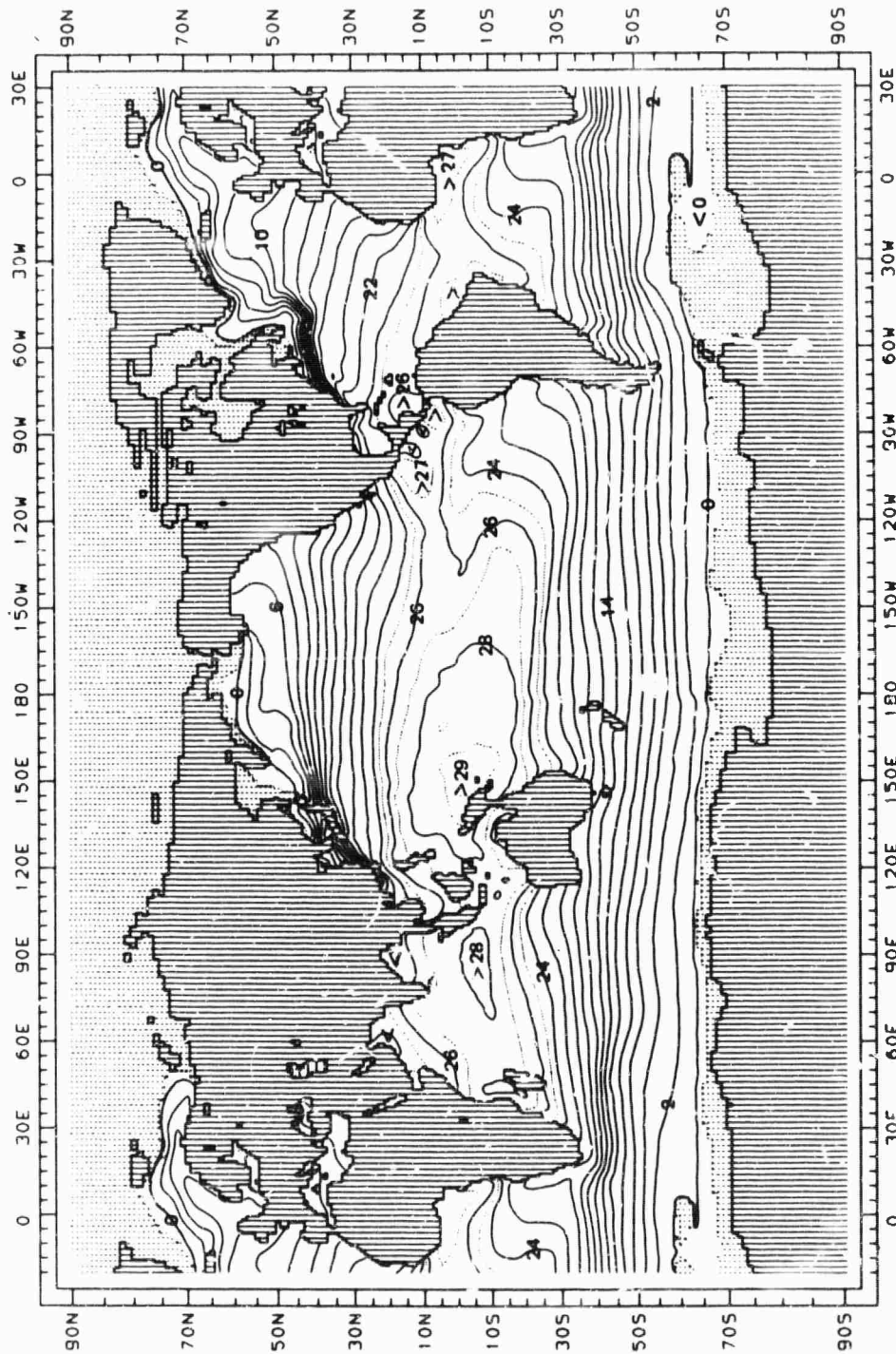
Fig. 1 — January average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
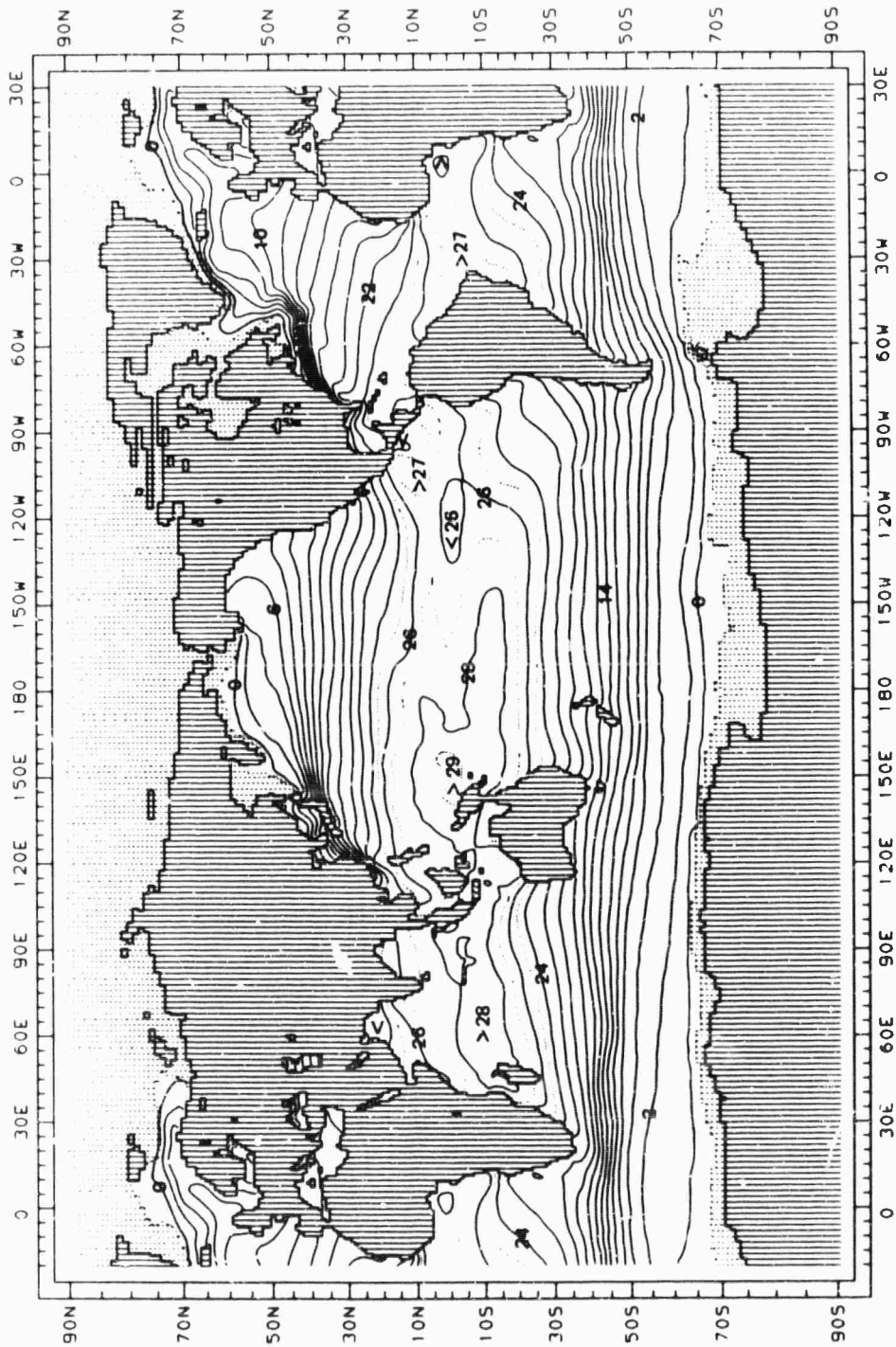
Fig. 2 — February average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
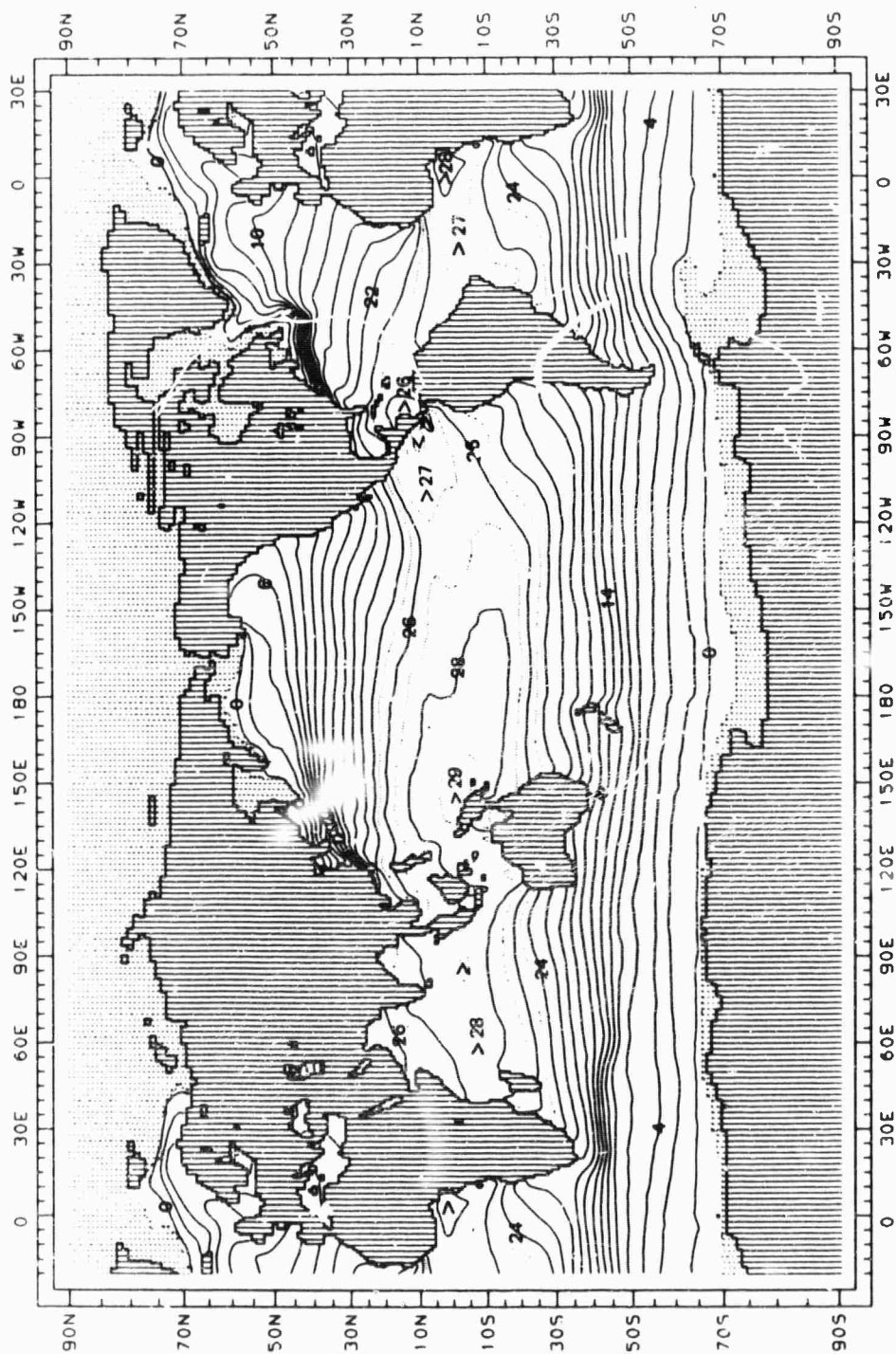
Fig. 3 — March average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
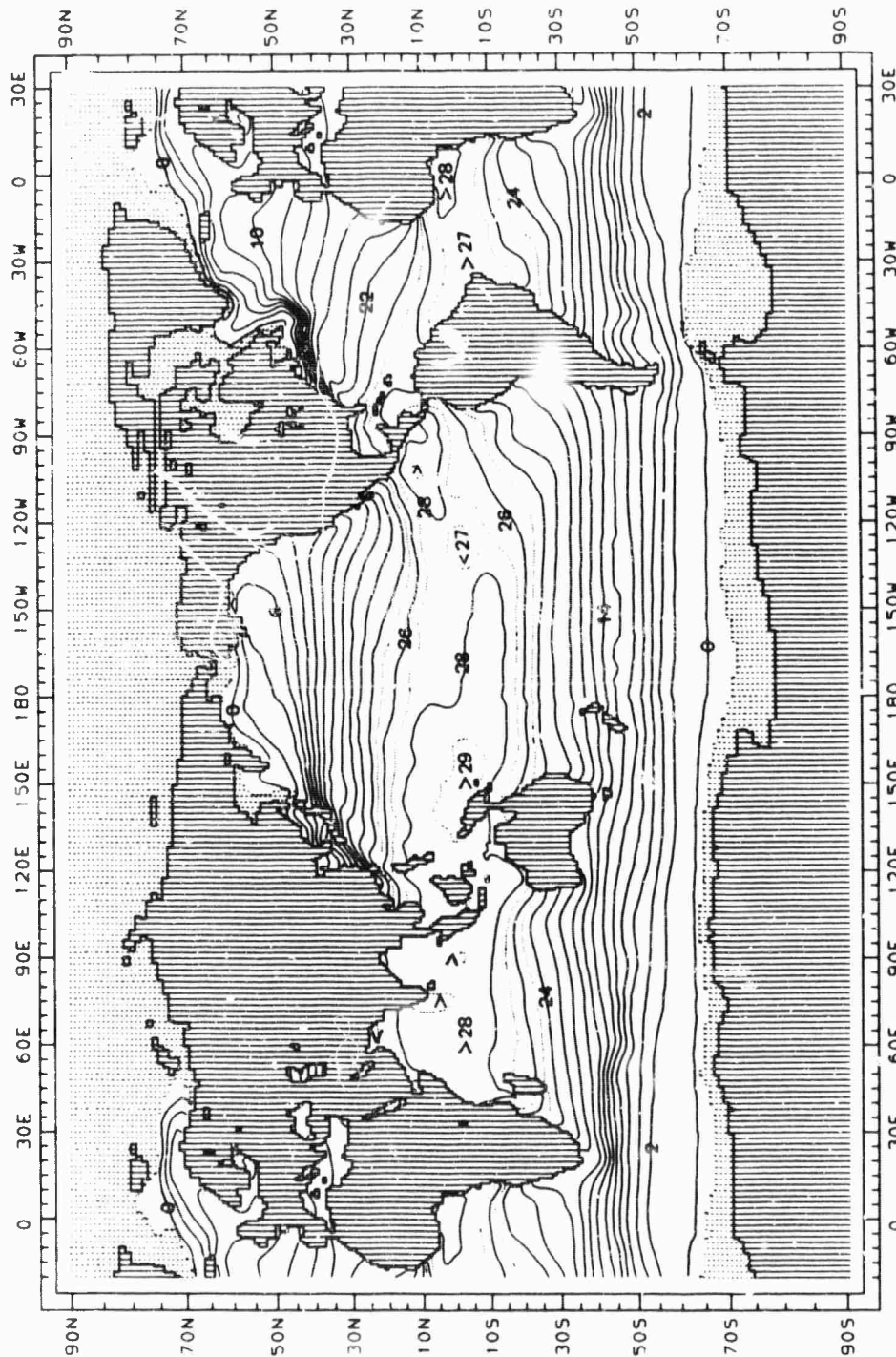
Fig. 4 — April average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
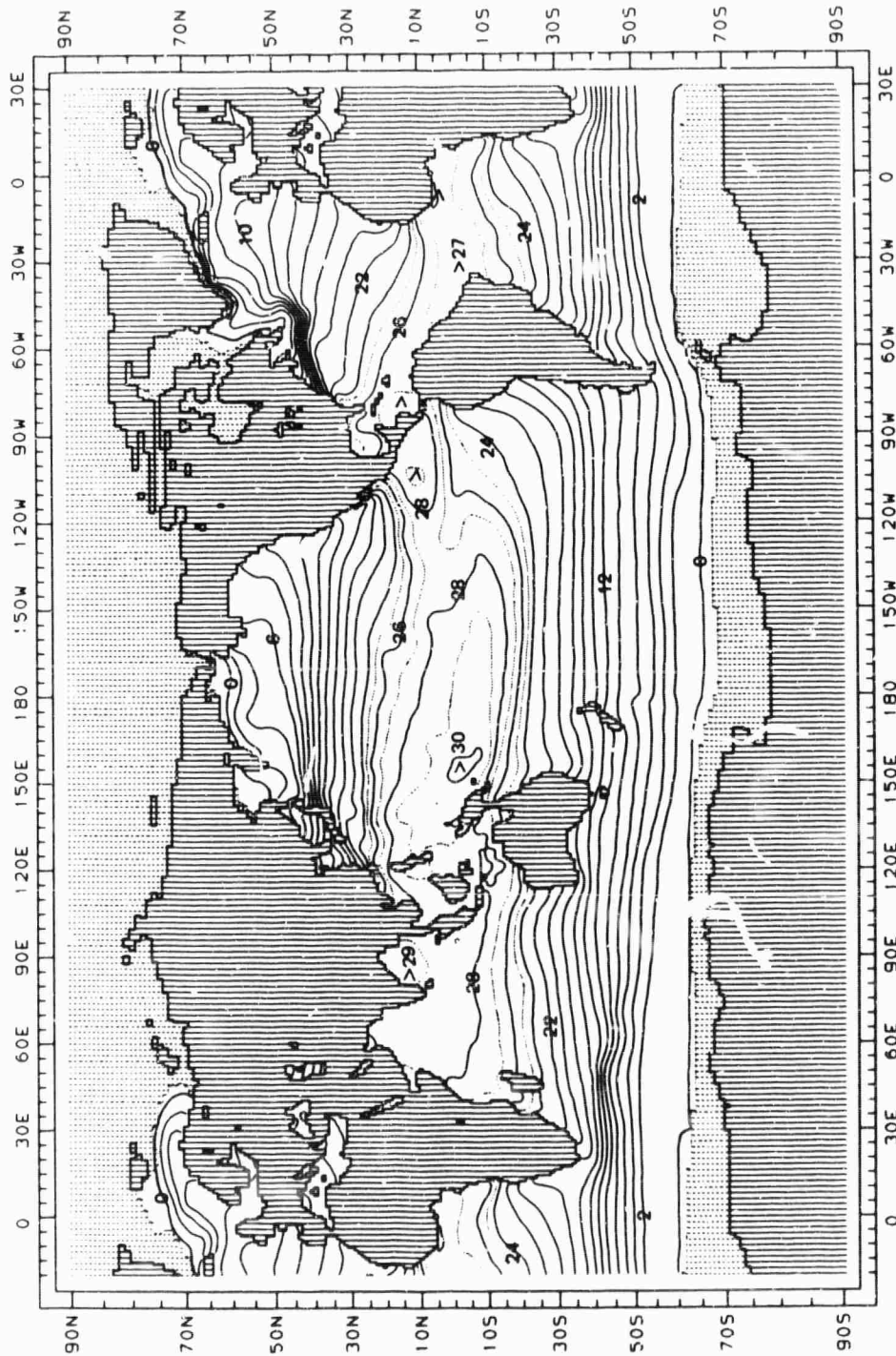
Fig. 5 — May average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
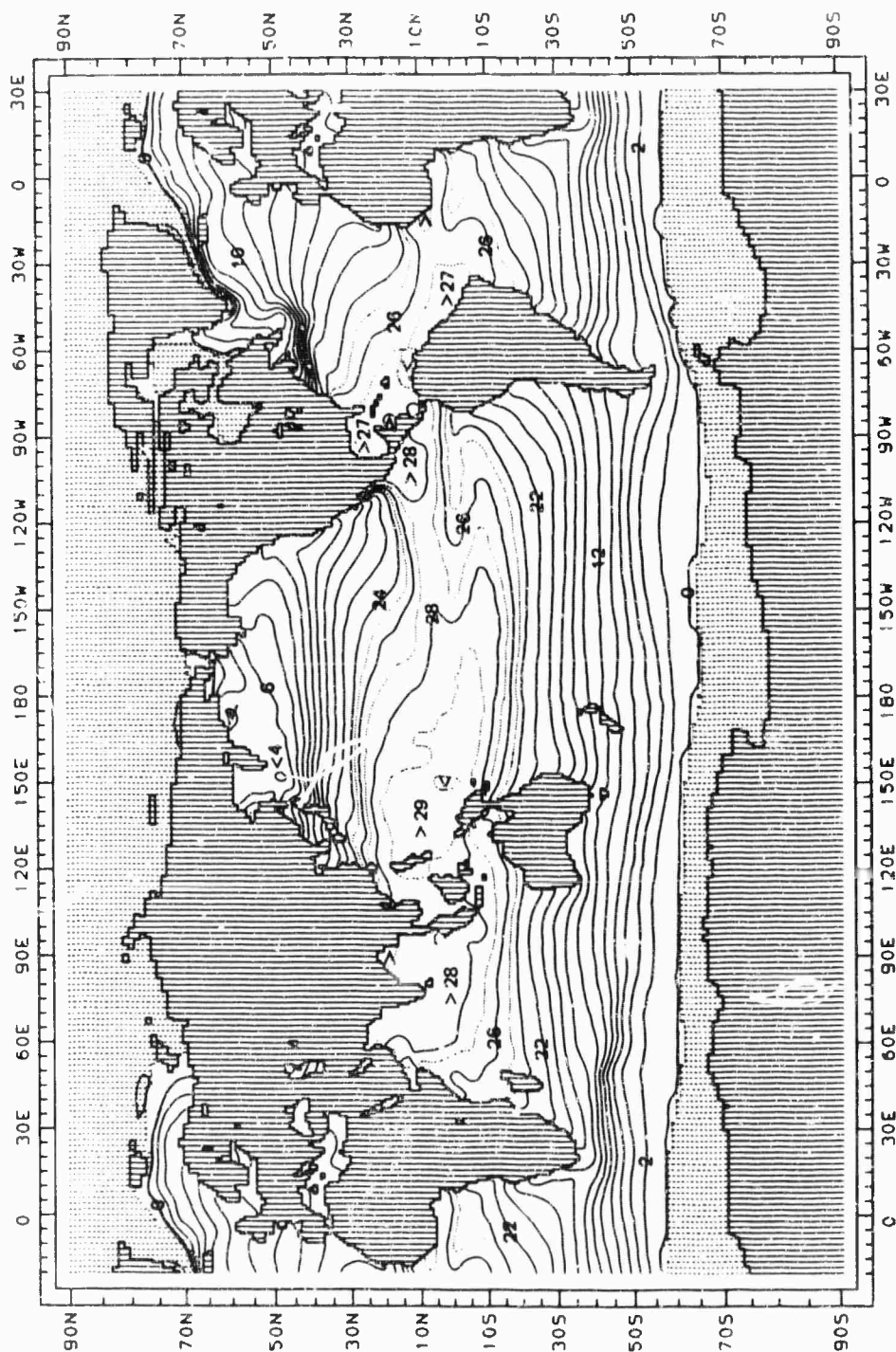
Fig. 6 — June average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
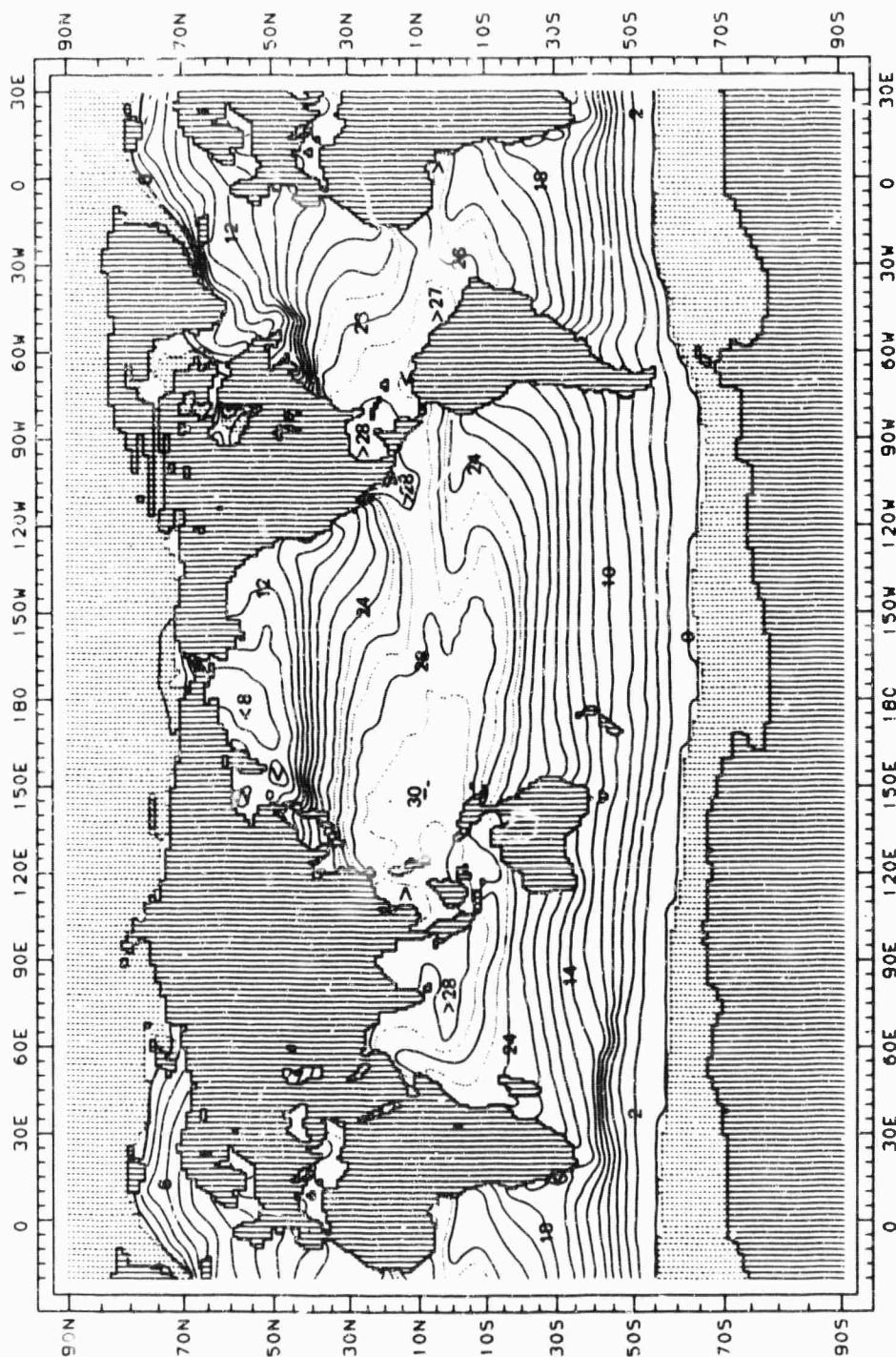
Fig. 7 — July average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
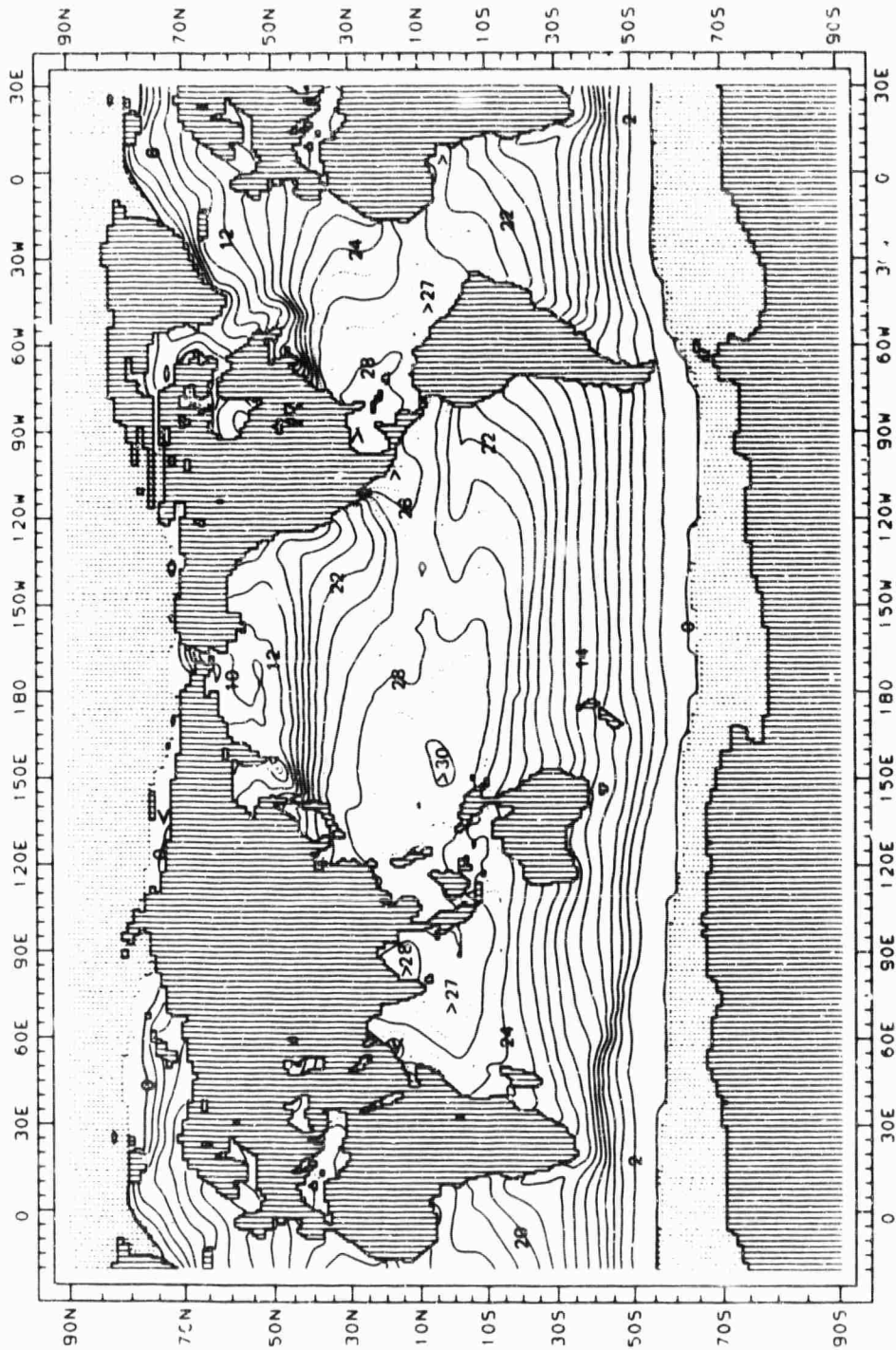
Fig. 8 — August average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
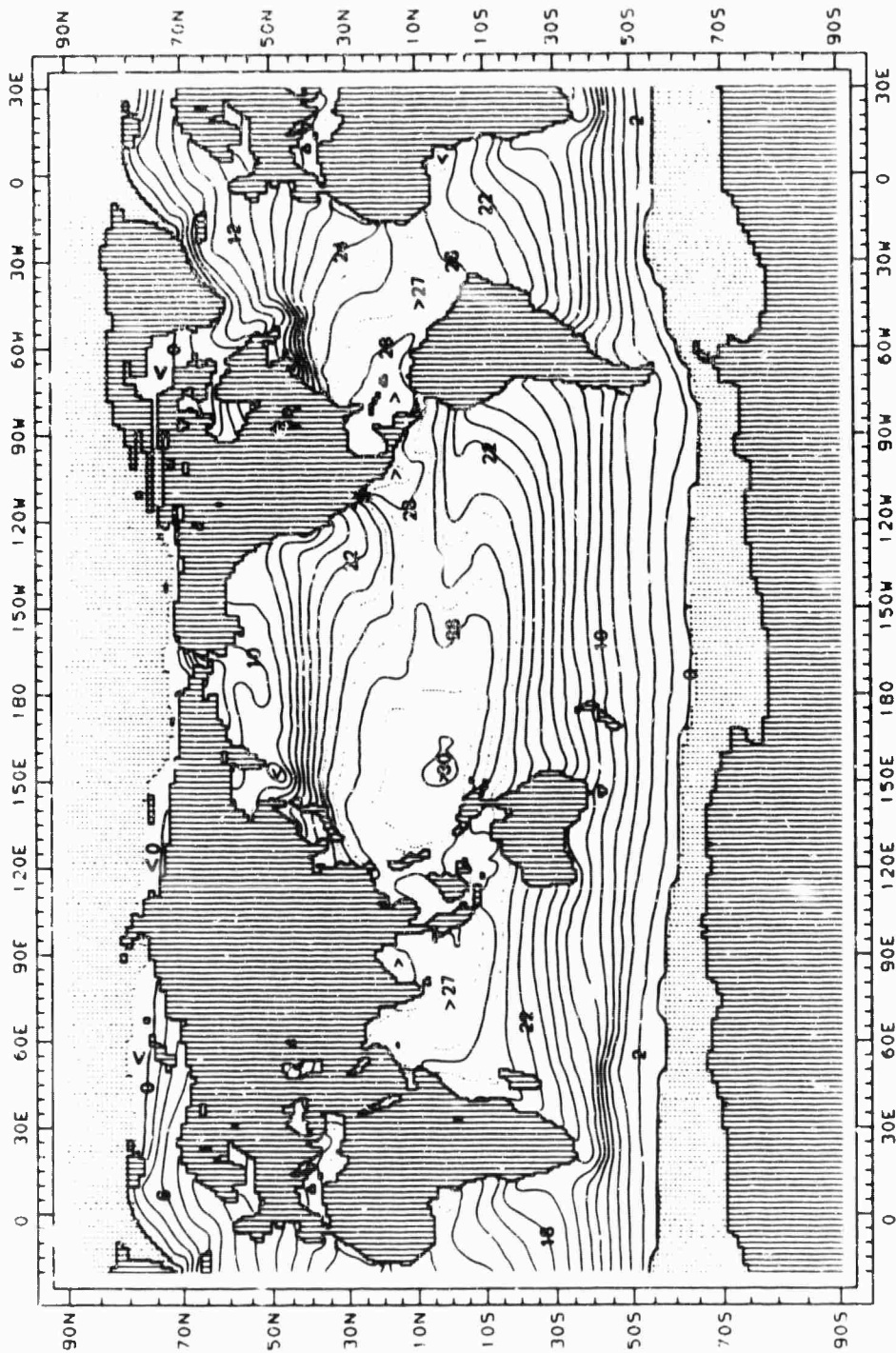
Fig. 9 — September average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
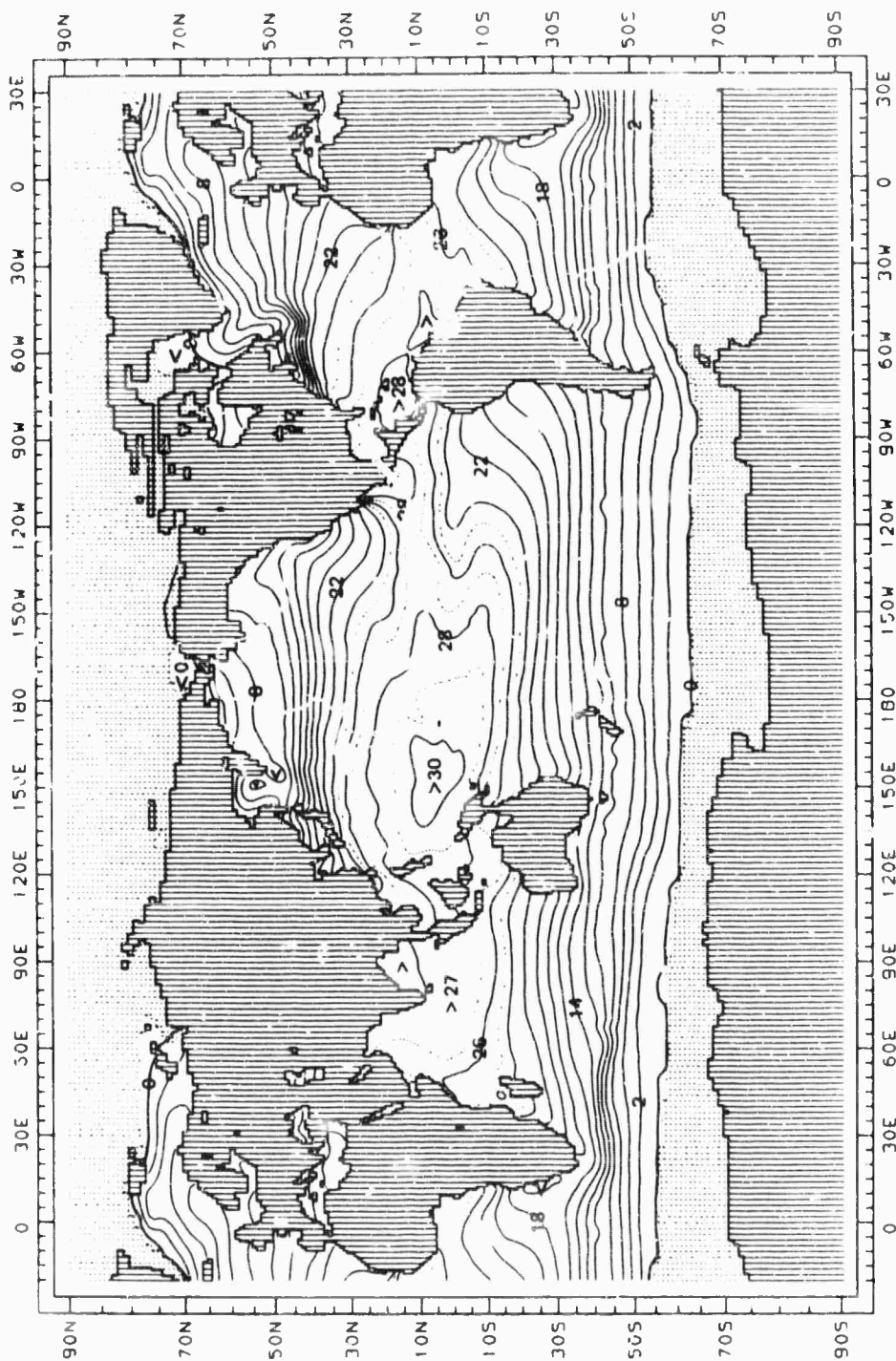
Fig. 10 — October average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
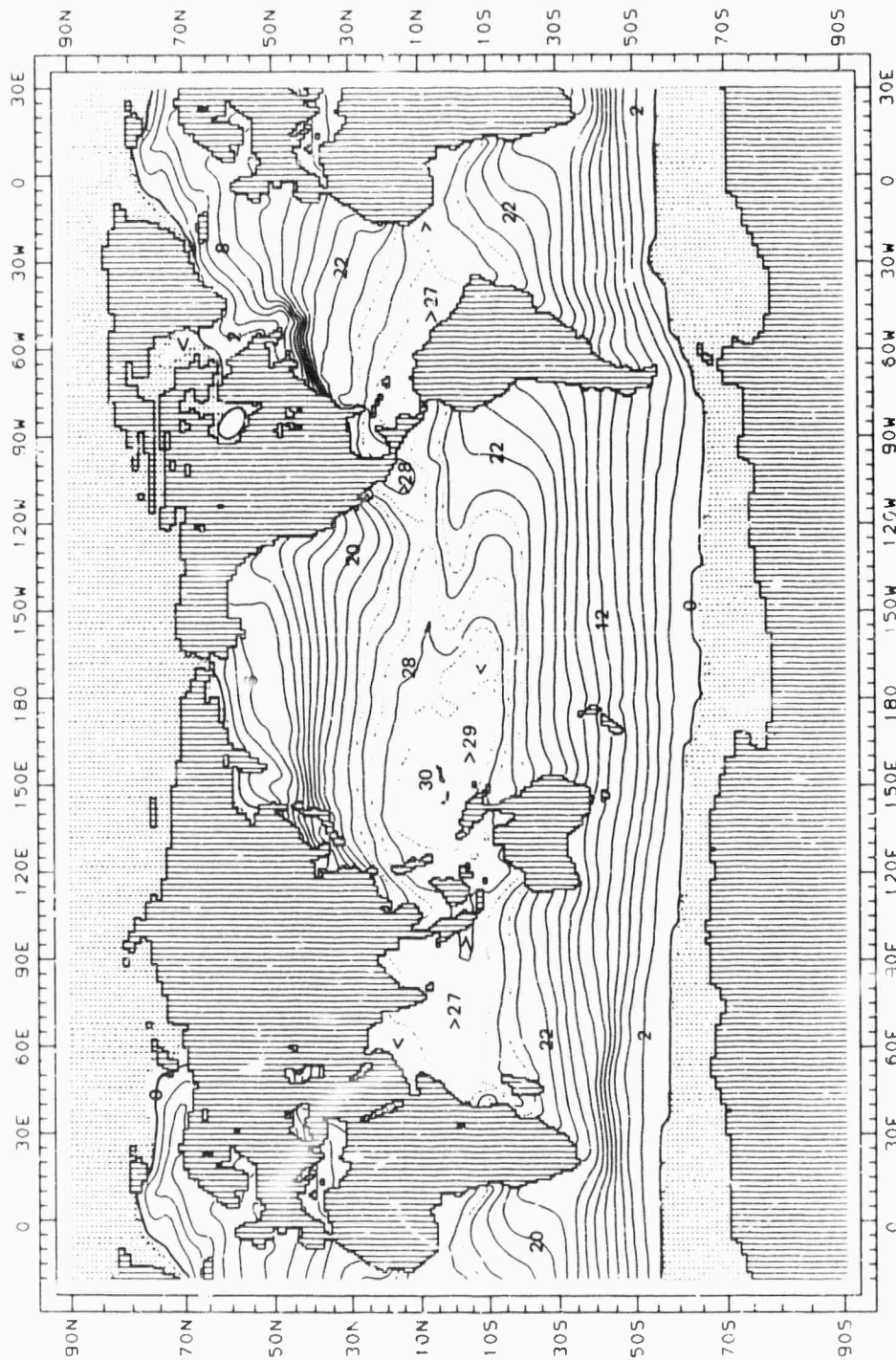
Fig. 11 — November average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°, 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
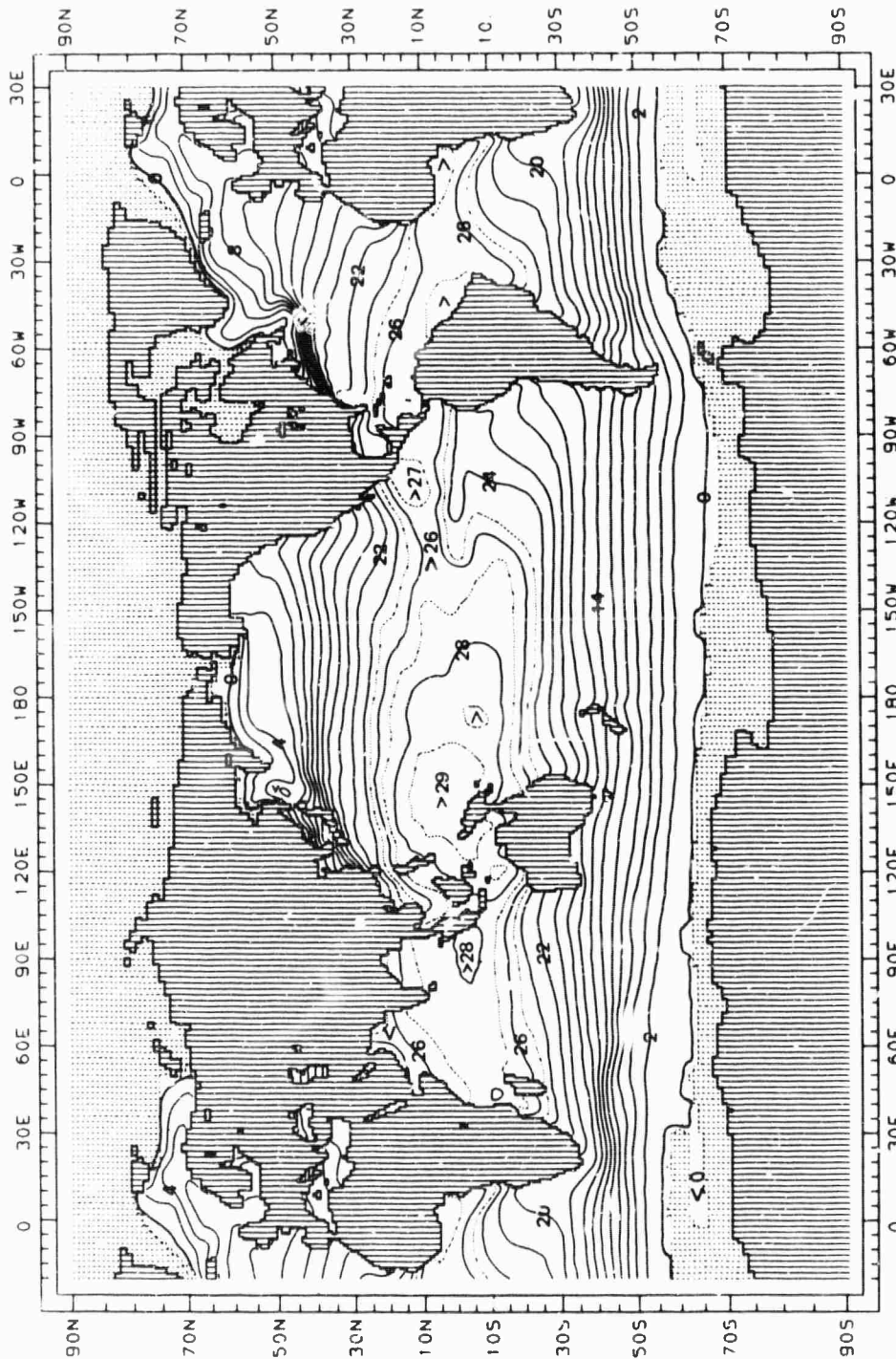
Fig. 12 — December average ocean-surface temperatures ($^\circ$C) and ice-pack distributions (broken hash marks). Solid isolines denote 0°, 2°, 4°. 6°C . . . . Dotted isolines in low latitudes denote 25°, 27°, and 29°C.
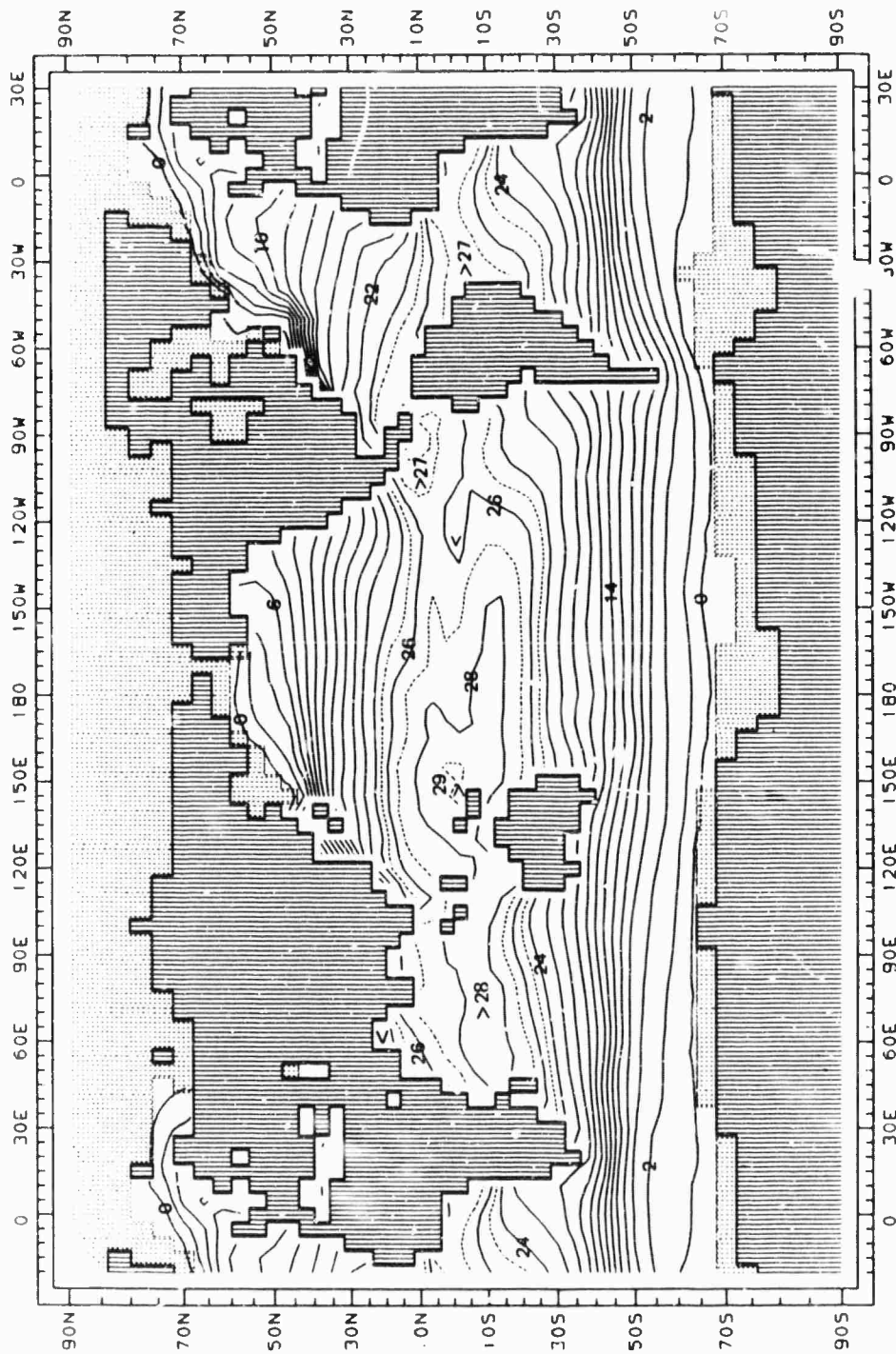
Fig. 13 — February average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks), averaged from basic data for mesh of 4° lat × 5° long. Solid isolines denote 25°, 27°, and 29°C. Dotted isolines denote 0°, 2°, 4°C . . . . Grid-point data are given in Table 1.

Fig. 14 — August average ocean-surface temperatures (°C) and ice-pack distributions (broken hash marks), averaged from basic data for mesh of 4° lat × 5° long. Solid isolines denote 25°, 27°, and 29°C. Dotted isolines denote 0°, 2°, 4°C.... Grid-point data are given in Table 2.

Table 1

FEBRUARY AVERAGE OCEAN-SURFACE TEMPERATURES. OPEN-WATER TEMPERATURES IN °C.
WATER TEMPERATURES BENEATH SEA ICE IN °K. ASTERISKS DENOTE LAND POINTS.

	180W	175W	170W	165W	160W	155W	150W	145W	140W	135W	130W	125W	120W	115W	110W	105W	100W	95W
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
78N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	*
74N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
70N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.1	271.2	271.2	271.1	*	*	*	*	*
66N	*	*	271.3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
62N	271.7	271.5	271.5	272.7	*	*	*	*	*	*	*	*	*	*	*	*	*	*
58N	0.5	0.2	0.1	3.2	3.8	4.5	4.7	5.5	6.4	7.3	7.7	*	*	*	*	*	*	*
54N	2.9	3.2	3.2	4.6	4.8	5.1	4.4	5.0	6.2	7.7	8.0	*	*	*	*	*	*	21.1
50N	3.8	4.3	4.4	6.9	7.2	7.4	5.5	6.2	6.9	9.1	9.6	9.5	*	*	*	*	*	22.6
46N	5.6	6.3	8.7	9.7	10.0	10.1	10.3	10.5	8.5	9.1	11.0	10.7	*	16.1	*	*	*	*
42N	9.4	9.5	9.7	12.8	12.9	13.1	13.2	13.4	10.7	11.1	12.9	12.3	14.3	18.1	22.2	25.3	*	25.9
38N	13.3	13.1	12.9	15.6	15.8	16.0	16.1	16.2	13.4	13.3	15.1	14.4	15.9	21.0	24.8	27.4	27.4	26.5
34N	16.3	16.0	15.7	18.7	18.7	18.8	18.9	18.9	16.2	15.7	17.1	16.4	17.9	23.6	26.0	27.0	27.2	27.1
30N	19.1	18.9	18.8	22.0	21.6	21.4	21.4	21.1	18.6	18.0	18.9	18.2	20.2	25.7	27.1	26.4	26.6	26.9
26N	22.1	22.1	22.0	23.9	23.6	23.4	23.2	22.9	20.6	19.8	20.7	20.2	22.6	26.7	27.0	26.1	26.2	26.2
22N	24.6	24.4	24.2	25.2	24.7	24.4	24.1	23.9	22.3	21.6	22.7	22.5	24.9	26.0	26.3	25.8	26.2	25.6
18N	26.0	25.0	25.5	25.6	25.3	25.1	25.0	24.3	23.6	23.2	24.4	24.4	26.2	25.6	25.8	25.3	25.6	26.0
14N	27.0	26.6	26.1	26.5	26.4	26.3	26.3	26.2	24.7	24.4	24.7	25.8	26.3	26.2	26.0	25.4	24.9	24.1
10N	27.7	27.2	26.6	27.1	27.0	26.8	26.7	26.8	26.0	25.9	26.7	26.8	26.4	26.2	25.7	24.7	24.3	23.5
6N	27.8	27.5	27.2	27.3	27.1	26.9	26.8	26.8	26.7	26.0	26.1	26.5	26.2	25.6	25.1	24.4	23.9	23.0
2N	27.4	27.3	27.4	27.8	27.7	27.5	27.4	27.3	27.2	26.9	25.7	26.5	26.3	26.2	24.7	24.0	23.5	22.6
2S	27.7	27.6	27.4	28.1	28.1	28.1	28.0	27.8	27.6	26.9	26.6	26.8	26.4	26.2	23.9	23.5	23.1	22.1
6S	28.1	28.0	28.0	28.1	28.1	28.1	28.1	28.0	27.6	27.4	27.1	26.8	26.4	26.0	23.0	23.1	21.1	21.0
10S	28.1	28.1	28.1	28.1	28.1	28.1	28.0	28.1	27.6	27.0	26.8	26.1	25.8	25.3	22.6	22.5	18.5	19.0
14S	28.1	28.1	28.1	27.7	27.5	27.5	27.5	27.4	27.2	26.3	26.2	26.1	25.8	25.3	24.7	21.1	15.3	15.6
18S	27.6	27.6	27.7	26.3	26.3	26.2	26.3	26.3	26.4	25.2	25.1	25.0	24.8	24.4	23.9	17.9	12.6	12.8
22S	26.2	26.3	26.3	24.4	24.4	24.5	24.7	24.9	25.0	23.2	23.2	23.0	22.7	22.6	22.0	15.2	10.9	10.3
26S	24.6	24.7	24.6	22.4	22.3	22.5	22.6	22.8	22.9	21.1	21.3	21.2	21.0	21.0	21.0	12.4	6.9	7.1
30S	22.7	22.7	22.5	20.3	20.2	20.4	20.6	20.8	20.8	18.6	18.9	18.8	18.5	18.3	18.1	9.6	4.3	4.4
34S	20.8	20.6	20.4	18.1	17.9	17.9	18.1	18.2	15.8	15.8	15.7	15.7	15.5	15.4	15.3	4.1	3.1	3.1
38S	18.9	18.7	18.4	15.9	15.8	15.6	15.8	15.8	12.6	12.5	12.6	12.4	12.4	12.4	12.3	3.1	0.8	0.8
42S	16.7	16.4	16.1	13.2	13.1	13.0	12.8	12.6	9.8	9.8	9.8	9.8	9.8	9.7	9.6	271.5	271.5	271.5
46S	13.1	13.1	13.2	9.7	9.6	9.7	9.7	9.9	9.8	9.8	6.2	6.2	6.2	9.7	0.9	*	271.4	*
50S	9.5	9.5	9.6	9.7	9.6	6.1	6.1	6.1	6.2	6.2	6.2	6.2	6.2	3.8	0.9	*	*	*
54S	5.9	5.8	5.8	6.0	6.0	3.6	3.1	3.5	3.4	3.5	3.7	3.7	3.8	2.9	4.0	*	*	*
58S	3.7	3.6	3.0	3.6	3.6	3.6	3.6	3.5	3.4	3.5	3.7	3.7	2.7	0.6	3.0	*	*	*
62S	2.5	2.5	2.4	2.4	2.2	2.1	1.9	1.8	1.9	2.1	2.4	2.5	0.5	0.6	0.7	271.5	271.5	271.5
66S	0.5	0.5	0.4	0.2	0.1	-0.2	-0.4	-0.4	-0.3	-0.0	0.1	0.1	271.5	271.5	271.6	271.4	271.4	*
70S	271.7	271.5	271.5	271.6	-1.3	-1.1	-1.4	-1.4	-1.4	-1.3	271.4	271.4	*	271.4	271.4	*	*	*
74S	271.4	271.4	271.4	271.4	271.4	*	271.4	271.4	*	271.4	271.4	271.4	*	*	*	*	*	*
78S	271.4	271.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 1--Continued

	5W	10W	15W	20W	25W	30W	35W	40W	45W	50W	55W	60W	65W	70W	75W	80W	85W	90W
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.4	271.3	*	*	*	*	*	*	*	*	*	*	*	*	271.2	*	*	271.2
78N	271.6	271.4	271.4	*	*	*	*	*	*	*	271.2	*	*	271.2	271.2	*	*	*
74N	-1.3	271.5	271.3	271.9	*	273.8	271.8	*	*	*	271.2	271.3	271.2	271.4	*	271.2	*	*
70N	1.2	0.0	272.5	1.9	1.9	6.9	4.4	272.9	1.9	-0.6	271.6	271.5	*	*	*	271.2	271.2	271.2
66N	3.7	3.4	3.0	7.1	7.1	7.4	.3	4.0	4.1	1.7	-0.3	272.1	271.6	*	*	271.2	271.2	271.2
62N	6.9	7.2	7.5	8.0	8.3	8.2	7.1	5.6	5.4	1.1	0.3	272.1	*	271.4	*	271.2	271.2	271.2
58N	*	8.3	8.9	9.8	9.1	10.1	9.5	8.9	7.1	0.2	271.9	*	*	*	*	271.2	*	*
54N	*	8.8	9.9	10.8	10.6	12.4	12.3	11.7	13.5	1.5	0.5	271.4	*	*	*	*	*	*
50N	8.5	3.9	10.7	12.1	12.3	15.7	14.5	16.5	16.7	9.7	3.8	-0.8	*	3.9	7.5	20.4	*	22.4
46N	10.6	11.3	11.8	13.5	13.9	15.7	16.1	18.0	18.3	16.8	17.3	8.1	*	14.4	18.5	22.7	22.0	24.0
42N	*	12.7	13.1	15.0	15.3	17.3	17.6	19.5	19.8	18.5	18.7	17.3	*	19.0	21.4	25.1	25.5	*
38N	*	14.3	14.6	16.7	17.0	18.9	20.7	21.0	21.4	20.0	20.1	18.4	*	20.3	23.0	25.8	25.7	26.6
34N	*	15.8	16.2	18.1	18.6	20.5	22.0	22.3	22.7	21.7	22.3	20.1	*	22.4	24.9	26.0	25.9	*
30N	*	*	17.2	18.9	19.9	21.6	22.9	23.2	23.6	23.0	23.6	23.8	*	22.4	25.7	26.4	27.1	26.6
26N	*	*	17.6	19.5	20.6	22.3	22.9	24.0	24.4	24.0	24.5	24.9	*	25.5	25.5	26.6	27.5	27.1
22N	*	*	*	21.1	21.1	23.2	23.7	24.3	24.6	24.9	25.1	25.5	*	25.4	*	26.0	27.7	26.9
18N	*	*	*	*	22.4	23.2	24.9	25.1	25.2	25.8	26.1	25.8	*	*	*	26.4	*	*
14N	*	*	24.5	24.2	24.3	24.5	26.1	26.4	26.3	26.6	*	*	20.0	*	*	23.0	27.1	27.1
10N	27.8	27.7	27.1	26.7	26.1	25.9	27.0	25.1	27.1	27.1	*	*	*	*	22.6	23.0	27.5	26.9
6N	27.2	27.0	27.5	27.1	27.0	26.7	27.4	26.4	*	*	*	*	*	*	21.9	21.7	26.7	26.2
2N	26.3	26.2	27.1	27.3	27.3	27.3	27.5	27.4	*	22.0	*	16.1	*	*	20.6	20.8	26.2	25.8
2S	25.1	25.3	26.4	26.9	26.6	27.4	27.5	*	25.2	19.3	*	13.2	*	*	19.2	23.1	25.7	25.1
6S	24.2	24.6	25.7	26.1	26.1	27.0	27.2	26.0	24.1	15.4	14.0	10.4	*	*	17.8	19.0	25.3	24.1
10S	23.5	24.2	25.1	25.5	26.1	26.7	27.1	25.3	21.5	11.8	11.4	7.4	*	0.1	16.5	17.6	24.4	23.0
14S	23.0	23.7	24.7	25.3	25.8	26.4	27.0	23.6	18.7	8.4	8.6	4.1	*	2.3	14.8	15.4	22.9	22.5
18S	22.1	22.9	24.0	25.0	25.5	25.8	26.1	21.1	12.5	4.9	5.5	0.3	*	-0.6	12.9	12.6	22.0	22.1
22S	21.3	22.0	23.0	24.4	24.9	25.1	25.1	23.6	11.3	1.9	1.3	271.4	*	*	10.8	10.2	21.5	21.5
26S	19.4	20.2	22.6	23.2	23.7	23.7	23.4	25.3	7.3	-0.7	271.7	271.4	*	*	8.8	8.0	20.9	20.5
30S	16.8	17.4	18.0	21.6	21.7	21.6	21.2	23.6	4.2	271.4	271.4	*	*	*	8.0	5.2	19.8	18.8
34S	12.4	14.9	13.7	14.3	14.7	15.1	15.2	15.3	1.5	271.4	271.4	*	*	*	5.7	3.0	18.2	15.6
38S	7.7	7.9	8.2	8.5	8.6	9.1	10.0	10.7	-0.9	*	*	*	*	*	2.7	6.3	12.5	12.8
42S	3.7	3.8	4.2	4.6	4.9	5.4	6.0	6.6	271.4	271.4	271.7	271.4	*	*	-0.2	271.5	10.0	10.2
46S	1.8	1.8	2.0	2.2	2.4	2.7	3.0	3.4	271.4	271.4	271.4	271.4	*	*	271.5	*	271.5	271.5
50S	0.8	0.8	0.8	0.6	0.7	2.0	1.1	-1.2	271.4	271.4	271.4	*	*	*	*	*	*	*
54S	0.3	0.1	-0.1	-0.5	-0.6	-0.8	271.9	271.4	271.4	271.4	271.4	*	*	*	*	*	*	*
58S	-1.3	-1.2	-1.2	-1.3	-1.5	271.5	271.4	271.4	271.4	271.4	271.4	*	*	*	*	*	*	*
62S	271.4	271.5	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	*	271.4	*	*	*	*	*	*
66S	*	*	*	271.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*
70S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
74S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
78S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 1--Continued

	0	5E	10E	15E	20E	25E	30E	35E	40E	45E	50E	55E	60E	65E	70E	75E	80E	85E
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.4	271.4	271.5	271.4	271.4	271.4	271.3	271.3	271.3	271.3	271.3	271.2	271.2	271.2	271.3	271.2	271.2	271.2
78N	-1.3	-0.9	-0.6	*	271.8	271.5	271.5	271.5	271.5	271.4	271.4	271.3	271.3	271.3	271.3	271.2	*	*
74N	-0.8	0.1	1.2	2.3	2.0	1.6	1.6	0.5	-0.3	-0.9	271.8	*	271.4	271.3	271.3	271.2	*	*
70N	2.9	4.8	5.2	5.0	*	*	2.4	1.4	0.9	272.8	271.9	271.5	271.4	271.3	*	271.2	*	*
66N	5.4	6.3	4.9	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
62N	6.6	5.0	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
58N	6.2	4.6	1.5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
54N	*	4.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
50N	*	*	*	*	*	*	*	*	*	*	277.5	*	*	*	*	*	*	*
46N	*	*	*	*	0.7	*	*	*	25.6	*	*	*	*	*	*	*	*	*
42N	13.8	12.5	12.5	14.1	14.5	13.8	7.3	7.6	*	*	8.4	*	*	*	*	*	*	*
38N	*	14.0	14.1	15.4	15.4	15.6	16.1	*	*	*	12.1	*	*	*	*	*	*	*
34N	*	*	*	*	*	*	*	17.0	*	*	*	*	*	*	*	*	*	*
30N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
26N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18N	*	*	*	*	*	*	*	*	*	*	*	*	22.7	22.9	25.4	*	*	25.6
14N	*	*	*	*	*	*	*	*	*	26.0	25.1	25.0	24.0	24.3	26.7	*	26.9	26.2
10N	*	*	*	*	*	*	*	*	25.6	26.4	25.7	25.8	25.2	25.8	27.1	27.2	27.3	26.9
6N	28.0	28.0	*	*	*	*	*	*	*	27.6	26.0	26.5	26.1	26.7	27.2	27.3	27.7	27.4
2N	27.7	27.9	27.5	*	*	*	*	*	27.1	28.0	26.4	27.2	26.9	27.2	27.4	27.5	28.0	27.9
2S	26.6	27.4	26.7	*	*	*	*	*	27.5	28.0	27.1	27.9	27.4	27.4	27.9	27.9	28.1	28.0
6S	25.1	25.8	23.8	*	*	*	*	*	*	28.0	28.0	28.3	28.1	28.0	28.2	28.1	28.0	28.1
10S	23.8	23.7	21.5	*	*	*	*	*	27.8	*	28.1	28.1	28.4	28.2	28.2	28.1	27.0	28.1
14S	23.0	22.2	20.5	*	*	*	*	*	27.5	*	28.0	28.2	28.2	28.1	28.1	28.2	25.6	27.6
18S	23.0	21.5	20.1	*	*	*	*	*	26.4	26.2	28.0	28.0	27.7	27.5	27.3	27.1	24.1	26.5
22S	22.2	21.0	20.1	*	*	*	*	*	24.7	24.4	27.4	27.3	26.9	26.5	26.1	25.8	22.3	25.2
26S	21.6	20.5	19.6	20.5	*	*	23.3	25.7	22.4	21.9	26.0	25.7	25.4	25.1	24.8	24.5	19.9	23.7
30S	20.8	19.2	17.7	20.0	*	22.1	20.1	25.0	19.1	18.7	24.0	23.7	23.4	23.2	23.0	22.6	17.2	21.9
34S	19.1	16.8	13.5	18.8	20.1	20.6	14.5	22.9	13.4	13.2	21.4	21.1	20.9	20.6	20.3	20.2	13.2	19.6
38S	16.5	12.6	7.2	14.5	15.3	15.0	8.6	19.6	7.8	7.6	18.5	18.3	18.2	18.0	17.8	17.6	8.6	16.7
42S	12.4	7.1	3.4	7.5	8.1	3.8	4.1	14.1	4.4	4.5	13.5	14.1	14.4	14.5	14.1	13.6	4.7	12.7
46S	7.3	3.5	1.5	3.4	3.5	1.9	2.1	8.0	2.6	2.7	7.7	8.3	8.9	4.6	8.7	4.7	3.4	8.7
50S	3.7	1.5	0.8	1.7	1.9	1.5	1.5	4.2	1.5	1.5	4.6	4.6	4.6	3.1	4.7	3.3	1.8	4.8
54S	1.5	0.8	0.4	1.1	1.5	1.0	0.9	2.3	0.8	0.6	2.8	2.8	2.9	1.6	3.2	1.7	0.5	3.5
58S	0.8	0.3	0.4	0.8	1.0	-0.9	-1.2	1.5	271.8	271.3	1.5	1.5	1.5	0.5	1.6	0.5	271.7	2.1
62S	0.3	-1.3	-1.1	-1.0	-0.9	271.5	*	0.9	*	*	0.6	0.4	0.4	271.8	0.5	271.7	*	0.5
66S	-1.3	271.4	271.5	271.5	271.5	*	*	-1.3	*	*	271.7	271.4	271.5	*	271.8	*	*	271.4
70S	271.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
74S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
78S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 1--Continued

	90E	95E	100E	105E	110E	115E	120E	125E	130E	135E	140E	145E	150E	155E	160E	165E	170E	175E
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
78N	*	271.2	*	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
74N	*	*	*	*	*	*	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
70N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
66N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
62N	*	*	*	*	*	*	*	*	*	*	271.4	271.3	271.4	*	*	272.3	*	271.7
58N	*	*	*	*	*	*	*	*	*	*	0.2	271.5	271.8	271.8	272.0	0.7	-0.2	0.3
54N	*	*	*	*	*	*	*	*	*	*	4.7	271.7	272.4	-0.1	0.9	2.2	1.8	2.5
50N	*	*	*	*	*	*	*	*	*	*	*	271.9	0.3	1.7	2.8	3.2	2.9	3.4
46N	*	*	*	*	*	*	*	*	6.8	*	15.8	2.3	3.9	5.9	7.1	7.8	4.1	5.0
42N	*	*	*	*	*	*	*	*	12.5	2.2	18.8	10.5	11.8	12.4	12.7	13.1	8.3	9.0
38N	*	*	*	*	*	*	*	*	18.6	6.9	21.5	17.1	17.0	16.6	16.6	16.7	13.3	13.4
34N	*	*	*	*	*	*	*	*	21.0	*	24.3	19.2	19.2	19.0	19.0	19.1	16.8	16.7
30N	*	*	*	*	*	*	*	*	23.3	18.5	26.5	21.9	21.8	21.6	21.7	22.0	19.2	19.2
26N	*	26.6	*	26.2	22.5	18.4	22.7	*	25.6	21.1	27.6	24.6	24.5	26.5	24.5	24.6	22.3	22.4
22N	25.5	27.3	27.1	26.5	24.1	22.9	25.1	3.6	27.1	23.7	28.0	26.5	26.6	26.8	26.4	26.0	24.6	24.7
18N	26.3	27.9	27.5	27.1	25.3	25.4	26.2	8.7	27.7	26.0	28.6	27.4	27.5	27.5	27.2	27.0	26.0	26.0
14N	27.0	28.1	*	*	25.1	26.3	26.8	14.2	27.7	27.4	28.8	28.1	28.2	28.1	27.9	27.7	26.9	27.0
10N	27.6	28.0	28.0	28.8	27.1	26.8	27.6	20.4	28.1	27.8	28.9	28.6	28.7	23.8	28.4	28.2	27.7	27.8
6N	28.1	28.0	28.4	28.6	27.9	*	27.8	23.6	28.3	28.1	*	29.1	28.8	29.1	28.8	28.1	28.4	28.2
2N	28.0	28.1	28.1	27.6	28.4	28.0	27.9	25.5	28.1	28.4	27.9	*	29.1	29.1	28.6	28.1	28.1	27.8
2S	28.0	27.0	27.3	25.9	28.3	28.1	28.3	26.7	27.3	*	27.2	28.1	28.7	28.7	28.1	28.1	27.9	27.8
6S	28.0	25.7	25.6	24.0	28.0	28.3	28.9	27.5	*	28.3	*	27.6	28.2	28.2	28.1	28.0	28.0	28.1
10S	28.1	24.3	24.0	22.5	26.8	28.3	28.4	27.7	*	27.5	*	*	28.1	28.1	28.1	27.5	28.1	28.1
14S	27.2	22.8	22.5	20.7	24.9	*	*	28.0	*	*	*	*	27.4	27.6	27.6	26.3	28.0	27.6
18S	26.0	21.1	20.7	18.7	22.9	*	*	28.0	*	*	*	*	26.1	26.4	26.3	24.7	27.5	26.3
22S	24.7	19.0	18.7	15.8	21.0	*	*	28.2	*	*	*	*	*	25.1	25.0	23.3	26.3	24.6
26S	23.3	15.9	15.7	12.1	18.8	15.2	*	28.3	*	*	*	*	*	23.9	23.8	21.1	24.6	22.6
30S	21.5	12.0	12.0	8.9	16.0	15.0	16.1	*	*	16.6	*	*	*	22.1	21.9	18.6	22.8	20.5
34S	19.3	8.4	8.6	5.5	12.3	12.3	12.5	18.8	18.8	13.7	17.0	15.2	19.0	19.7	19.3	16.1	20.5	18.5
38S	16.3	4.9	5.2	3.9	9.1	9.3	9.6	16.2	16.4	10.7	14.5	11.8	16.2	16.5	16.2	13.1	18.3	16.6
42S	12.3	3.7	3.8	2.7	6.0	6.3	6.7	12.8	13.2	7.8	11.2	15.2	12.3	12.7	13.0	10.3	16.2	13.0
46S	8.4	2.4	2.6	0.6	4.0	4.1	4.4	9.8	10.2	5.3	8.2	11.8	9.8	9.6	10.1	5.9	13.3	9.7
50S	4.8	0.5	*	*	2.8	3.0	3.1	7.1	7.5	3.6	5.5	8.5	5.5	5.6	5.8	3.8	10.0	5.9
54S	3.6	*	*	*	0.7	0.8	0.9	4.6	4.9	1.5	3.7	5.5	3.8	3.6	3.8	2.4	5.9	3.8
58S	2.3	*	*	*	271.5	271.5	271.5	3.2	3.3	272.4	1.7	3.7	1.9	2.1	2.2	0.2	3.8	2.5
62S	0.5	*	*	*	*	*	*	0.9	1.1	*	272.4	1.9	-0.5	-0.5	-0.3	271.5	2.5	0.3
66S	271.5	*	*	*	*	*	*	271.5	271.7	*	*	272.5	*	*	271.4	*	0.2	271.5
70S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	271.5	271.4
74S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	271.4	271.4
78S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 2

AUGUST AVERAGE OCEAN-SURFACE TEMPERATURES. OPEN-WATER TEMPERATURES IN °C. WATER TEMPERATURES BENEATH SEA ICE IN °K. ASTERISKS DENOTE LAND POINTS.

	95W	100W	105W	110W	115W	120W	125W	130W	135W	140W	145W	150W	155W	160W	165W	170W	175W	180N
9CN	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
78N	271.3	271.3	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
74N	271.2	271.2	271.2	271.2	271.2	271.3	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
70N	271.4	*	*	*	*	*	*	*	0.1	*	*	*	*	*	1.6	0.5	-1.1	-1.0
66N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	7.5	*	*
62N	*	*	*	*	*	*	*	13.2	14.2	14.7	14.2	13.3	12.4	11.9	10.8	8.6	8.3	8.5
58N	*	*	*	*	*	*	*	14.9	15.3	14.5	13.6	13.2	12.6	12.3	11.0	10.4	10.6	10.4
54N	*	*	*	*	*	*	15.0	16.7	16.8	14.7	13.9	15.2	14.7	14.4	12.0	10.1	10.1	10.1
50N	*	*	*	*	*	17.9	14.9	17.2	16.2	16.3	15.9	18.6	18.5	18.4	14.3	11.4	10.8	10.7
46N	*	*	*	*	23.4	19.9	15.3	17.7	19.2	18.4	18.6	18.6	18.5	18.4	18.4	14.3	14.1	13.7
42N	*	*	*	28.5	22.9	22.0	17.2	18.7	20.3	20.2	21.2	21.8	21.8	22.0	22.5	18.5	18.7	18.5
38N	*	*	*	28.9	25.8	22.0	19.2	19.9	22.1	21.5	22.2	22.6	22.4	24.0	24.4	22.6	22.6	22.8
34N	*	*	*	28.8	27.6	24.4	21.0	20.9	23.0	22.4	23.5	23.7	25.0	25.6	25.4	24.7	24.9	25.1
30N	*	*	29.4	28.0	28.2	26.5	23.0	22.6	23.5	23.5	24.3	24.3	25.7	26.3	26.3	25.8	26.1	26.4
26N	*	*	29.1	28.8	27.8	27.7	25.4	25.1	25.1	25.4	25.8	24.9	25.2	26.3	26.7	26.5	26.9	27.4
22N	28.8	*	28.3	28.0	28.2	27.6	27.0	27.0	27.0	27.9	27.9	27.8	26.2	26.6	27.3	27.2	27.6	28.0
18N	28.5	28.6	26.9	26.6	26.5	27.6	27.2	27.5	27.5	27.6	27.5	27.8	26.9	27.3	27.7	27.6	28.0	28.3
14N	27.9	27.9	24.8	24.7	24.6	24.6	26.3	26.9	25.8	26.4	26.7	26.9	27.9	28.0	27.7	27.8	27.9	28.4
10N	27.2	27.3	23.0	23.2	23.3	23.9	24.5	25.1	25.0	25.8	26.6	26.9	28.1	28.1	28.3	28.0	28.0	28.4
6N	26.4	26.6	23.6	24.0	24.4	24.8	25.1	25.6	26.4	26.9	26.6	27.2	27.2	27.7	28.4	28.7	29.0	29.0
2N	24.5	24.8	23.5	24.2	24.4	25.1	25.3	25.5	26.5	27.0	27.2	27.1	27.1	27.8	28.5	28.9	29.3	29.4
2S	22.4	22.8	23.0	24.0	24.3	24.8	25.1	24.8	25.0	26.9	27.2	26.9	27.9	28.0	29.1	29.1	29.3	29.3
6S	22.3	23.1	23.6	24.2	24.6	25.1	25.3	25.6	26.4	27.0	27.2	27.3	27.8	28.2	27.1	29.1	29.3	29.3
10S	22.0	22.8	23.5	24.0	24.4	24.8	25.1	25.5	26.5	26.3	26.6	26.8	27.0	28.0	27.1	28.3	28.3	28.2
14S	21.4	22.3	23.0	23.7	24.3	25.1	24.6	24.8	25.0	26.3	26.6	25.2	25.5	27.1	25.1	27.0	26.9	26.7
18S	20.8	22.3	22.6	23.7	23.7	24.2	24.6	23.3	23.3	25.1	25.1	22.8	22.5	25.4	22.2	25.1	24.8	24.7
22S	20.0	21.7	21.4	22.9	22.4	22.9	23.1	23.3	20.7	23.2	23.0	20.0	19.7	19.6	19.5	22.1	22.1	22.0
26S	18.7	20.8	20.0	21.9	20.7	20.9	20.9	20.9	20.7	20.5	20.3	17.2	17.1	17.2	17.2	19.4	19.5	19.4
30S	17.1	19.4	17.8	18.0	18.1	18.2	18.0	17.9	17.7	15.2	17.3	15.1	15.1	15.1	15.2	17.2	17.3	17.2
34S	15.2	17.5	15.5	15.6	15.5	15.4	15.3	15.2	15.2	15.2	15.2	15.1	15.1	15.1	15.1	15.1	15.2	15.2
38S	13.3	15.4	13.5	13.3	13.2	13.1	13.0	13.0	13.1	13.2	13.3	13.4	13.4	13.4	13.4	13.4	13.3	13.4
42S	11.0	13.4	11.2	11.2	11.1	11.1	11.0	10.8	10.7	10.8	11.0	11.4	11.4	11.5	11.4	11.4	11.3	11.1
46S	8.7	11.1	8.6	8.5	8.4	8.4	8.3	8.3	8.4	8.4	8.5	8.5	8.5	8.6	8.7	8.7	8.6	8.5
50S	6.0	8.7	5.9	6.0	5.9	5.8	5.8	5.8	5.7	5.8	5.8	5.8	5.7	5.8	5.9	5.9	6.5	6.1
54S	3.7	5.9	3.9	3.6	3.5	5.8	5.5	3.4	3.4	3.4	3.4	3.4	3.4	3.3	3.4	3.5	3.7	3.9
58S	1.3	3.6	1.9	1.9	1.9	1.8	1.9	1.9	1.8	1.7	1.7	1.6	1.6	1.6	1.6	1.7	1.8	2.0
62S	0.9	1.9	0.9	0.9	0.8	0.8	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.3	0.4	0.7	0.7	0.7
66S	-0.6	0.9	-0.6	-0.6	272.5	272.5	271.7	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.7	272.4	272.4	272.2
70S	271.4	-0.6	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4
74S	*	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4
78S	*	271.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	271.4
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 2--Continued

	90W	85W	80W	75W	70W	65W	60W	55W	50W	45W	40W	35W	30W	25W	20W	15W	10W	5W
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.3	*	*	272.5	*	*	*	*	*	*	*	*	*	*	*	*	271.4	271.5
78N	*	*	*	2.7	-0.4	2.9	2.6	*	*	*	*	*	*	*	*	271.4	272.1	0.7
74N	*	*	*	*	3.4	0.5	2.7	4.5	*	*	*	*	*	*	*	0.6	2.4	4.0
70N	*	*	-1.2	*	*	*	1.3	4.1	*	*	*	*	*	*	2.6	4.5	5.9	7.3
66N	*	*	4.7	*	1.8	1.6	3.8	5.4	*	*	*	2.2	5.9	8.3	8.6	8.4	8.3	9.2
62N	5.9	6.2	6.9	*	*	*	5.0	7.0	*	*	5.9	9.2	10.5	11.3	11.5	11.4	11.2	11.5
58N	6.0	5.6	9.2	*	*	*	*	7.5	4.6	*	8.7	10.4	11.5	12.4	12.9	13.2	13.4	*
54N	*	*	*	*	*	*	*	*	8.2	7.7	11.7	12.3	13.3	14.1	14.6	14.9	15.1	*
50N	*	*	*	*	*	*	13.0	*	9.2	10.9	15.5	15.6	15.8	16.2	16.2	16.3	16.3	15.9
46N	*	*	*	*	*	*	16.4	15.3	10.6	13.0	19.3	19.3	18.9	18.6	18.3	18.1	18.0	18.5
42N	*	*	*	24.2	18.5	18.4	20.9	21.1	13.7	16.3	22.5	22.0	21.4	20.7	20.2	19.7	18.9	*
38N	*	*	28.2	27.3	25.0	25.6	25.7	25.6	20.7	24.9	24.6	23.8	23.1	22.4	21.8	21.0	19.7	*
34N	*	*	28.2	28.1	27.1	27.0	26.8	26.7	25.0	26.0	25.5	24.9	24.3	23.5	22.6	21.9	21.7	*
30N	*	*	28.7	28.2	27.8	27.6	27.5	27.0	26.5	26.2	25.6	25.0	24.5	23.6	22.7	21.8	*	*
26N	29.0	28.9	28.2	28.0	28.2	27.9	27.3	27.1	26.8	26.1	25.4	24.9	24.3	23.6	22.6	21.2	*	*
22N	28.8	28.9	28.4	27.7	28.0	28.1	27.5	27.2	26.8	26.1	25.6	25.5	24.0	24.0	23.1	*	*	*
18N	*	28.8	27.9	*	27.7	27.9	27.6	27.4	26.6	26.4	25.9	26.4	25.3	25.0	25.3	*	*	*
14N	*	*	27.6	*	*	*	27.9	27.8	26.9	26.8	26.6	27.0	26.5	26.2	26.5	*	*	*
10N	27.0	27.2	25.4	*	*	*	27.8	27.9	27.3	27.5	27.2	26.7	26.8	26.3	26.4	26.4	24.3	24.2
6N	26.3	26.5	*	*	*	*	*	*	27.7	27.7	26.9	26.3	26.1	26.0	25.8	25.7	23.2	22.7
2N	24.8	25.0	*	*	*	*	*	*	27.8	27.3	27.3	25.9	25.9	25.5	24.3	24.2	23.2	22.5
2S	22.2	22.3	19.3	*	*	*	*	*	27.6	*	27.0	25.2	25.7	25.4	24.9	24.2	23.0	22.2
6S	21.3	20.6	18.5	*	*	*	*	*	*	*	27.3	24.5	25.1	24.9	24.4	23.7	21.9	21.0
10S	20.9	20.0	18.0	*	*	*	*	*	*	*	26.5	23.6	25.1	23.7	24.4	22.7	20.9	20.1
14S	20.0	19.4	17.5	*	*	*	*	*	*	*	*	22.4	24.1	23.6	23.3	22.7	19.8	19.1
18S	20.3	18.9	16.6	*	*	*	*	*	*	*	*	20.5	23.1	22.6	22.1	20.8	18.3	17.9
22S	19.7	18.2	15.4	*	*	*	*	*	*	19.9	22.2	18.0	22.0	21.6	21.2	16.9	16.7	16.6
26S	19.0	17.2	14.0	*	*	*	*	*	*	18.1	20.9	15.6	20.1	19.8	19.3	14.4	14.3	14.2
30S	18.0	15.9	12.4	17.3	*	*	*	*	15.0	12.7	18.1	12.9	15.2	17.5	17.2	12.0	11.9	11.7
34S	16.5	14.5	10.6	16.6	*	*	*	10.4	12.4	9.5	15.7	9.6	12.5	14.8	14.6	9.0	8.7	8.9
38S	14.8	12.8	8.7	15.8	*	*	7.9	8.8	9.5	7.0	13.0	5.7	9.3	12.2	12.1	4.6	4.7	4.9
42S	13.1	10.8	6.4	14.6	*	*	6.3	6.6	7.2	3.9	9.9	2.4	5.0	9.2	9.2	1.7	1.8	1.9
46S	10.9	8.7	3.7	11.8	*	6.5	4.5	4.6	4.7	1.5	6.4	0.9	2.0	4.8	4.7	0.4	0.5	0.6
50S	8.7	8.7	1.9	10.1	16.1	4.8	2.5	2.5	2.1	-0.2	3.0	271.9	0.5	1.8	1.8	271.6	271.6	271.8
54S	6.5	6.0	0.9	8.1	*	2.9	1.1	0.3	-0.1	271.4	1.2	271.4	271.4	271.4	0.3	271.4	271.4	271.4
58S	6.0	6.0	272.5	5.9	1.6	1.4	272.0	271.5	271.3	271.4	-0.3	271.4	271.4	271.4	271.6	271.4	271.4	271.4
62S	3.7	3.7	271.4	3.5	0.4	-0.1	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4
66S	1.9	2.0	*	1.7	271.4	271.4	*	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	*	*	*
70S	0.9	0.9	*	0.7	*	*	*	271.4	271.4	271.4	271.4	*	271.4	271.4	271.4	*	*	*
74S	-0.6	272.5	272.5	272.2	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4	271.4
78S	271.4	271.4	271.4	271.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 2--Continued

	0	5E	10E	15E	20E	25E	30E	35E	40E	45E	50E	55E	60E	65E	70E	75E	80E	85E
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.7	271.9	271.8	271.5	271.2	271.1	271.1	271.2	271.3	271.4	271.4	271.4	271.4	271.4	271.3	271.3	271.3	271.2
78N	2.7	4.3	4.6	*	0.6	-0.1	-0.2	-0.2	-0.4	-0.4	-0.1	0.3	0.3	-0.2	-0.8	-1.5	-1.9	271.3
74N	5.3	6.2	6.8	7.4	6.8	6.0	5.9	5.3	4.5	4.0	4.1	6.2	4.5	3.6	2.5	1.5	*	*
70N	8.4	9.5	9.9	10.0	*	*	9.3	8.5	7.4	6.7	6.4	*	5.9	5.6	*	*	*	*
66N	*	12.1	12.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
62N	10.9	13.5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
58N	12.6	15.0	*	*	15.8	*	*	*	*	*	*	*	*	*	*	*	*	*
54N	13.8	16.1	16.1	16.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*
50N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
46N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
42N	24.2	27.7	24.1	25.5	25.1	24.1	23.7	23.4	*	*	*	*	*	*	*	*	*	*
38N	*	26.5	24.9	26.2	26.0	25.3	26.1	27.7	30.1	*	*	*	*	*	*	*	*	*
34N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
30N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
26N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22N	*	*	*	*	*	*	*	*	*	*	20.0	*	*	*	26.7	*	*	*
18N	*	*	*	*	*	*	*	*	*	*	22.5	*	25.9	25.5	26.7	26.7	27.4	28.5
14N	24.5	*	*	*	*	*	*	*	*	*	25.8	24.6	24.1	25.8	27.1	27.1	27.1	28.5
10N	22.8	24.8	21.4	*	*	*	*	*	*	*	27.3	24.9	24.7	26.0	27.2	27.4	27.6	28.0
6N	22.1	23.0	20.2	*	*	*	*	*	*	*	26.2	25.1	25.5	26.5	27.3	27.5	27.5	27.3
2N	21.5	21.8	18.3	*	*	*	*	*	*	25.4	25.1	25.9	26.3	27.1	26.6	26.8	26.8	27.7
2S	20.2	20.5	16.6	*	*	*	*	*	*	25.2	25.2	26.2	26.9	27.2	25.5	25.6	25.7	27.8
6S	19.1	18.9	16.0	*	*	*	*	*	23.6	24.6	24.9	25.4	26.0	26.4	24.1	24.1	24.4	27.0
10S	18.4	17.9	16.0	*	*	*	*	*	23.2	23.8	24.0	24.5	25.0	25.2	22.7	22.5	22.4	25.8
14S	17.6	17.4	16.1	*	*	*	*	*	*	23.8	23.9	24.2	24.2	24.1	21.0	20.8	20.5	24.7
18S	16.4	17.0	16.2	*	*	*	*	*	23.7	*	23.3	23.4	23.2	24.1	19.1	18.8	18.6	22.4
22S	14.2	16.2	14.8	*	*	*	*	*	22.6	21.3	23.3	23.2	23.2	22.9	16.7	15.4	16.2	20.3
26S	11.6	14.2	12.2	*	*	*	*	21.1	21.3	19.4	22.4	22.2	21.4	21.4	14.6	14.3	13.9	18.4
30S	8.6	11.6	9.0	15.7	*	17.7	18.6	20.2	19.7	16.9	21.0	20.5	19.9	19.4	13.1	12.6	12.2	16.0
34S	4.8	8.6	5.0	15.8	16.0	16.2	15.8	18.4	17.5	14.4	18.6	17.8	17.4	17.0	10.8	10.4	10.1	13.5
38S	2.0	4.8	2.1	13.8	11.2	10.8	10.1	15.5	14.9	8.3	16.5	15.9	15.3	14.9	5.6	6.0	1.8	11.8
42S	0.7	2.0	0.6	10.0	4.9	5.1	5.2	9.4	8.5	3.9	14.2	14.2	14.1	13.6	1.5	1.5	0.7	9.9
46S	271.6	0.7	271.6	4.9	2.1	2.1	2.1	4.9	4.4	1.6	8.2	9.3	11.3	11.2	0.7	0.6	-0.4	6.6
50S	271.4	271.6	271.4	2.1	0.6	0.6	0.6	2.0	1.8	0.9	3.7	4.1	5.1	5.1	-0.3	-0.4	271.4	2.6
54S	271.4	271.4	271.4	0.6	271.6	271.6	271.6	0.8	0.9	272.8	1.6	1.7	1.8	1.7	271.4	271.4	271.4	0.9
58S	271.4	271.4	271.4	271.6	271.4	271.4	271.4	271.9	272.8	271.4	0.9	0.9	0.9	0.8	271.4	271.4	*	-0.3
62S	*	271.4	*	271.4	271.4	271.4	271.4	271.4	271.4	271.4	272.8	272.8	-0.3	-0.3	*	*	*	271.4
66S	*	*	*	271.7	271.4	271.4	*	271.4	*	*	271.4	271.4	271.4	271.4	*	*	*	271.4
70S	*	*	*	271.4	*	*	*	*	*	*	271.4	*	271.4	271.4	*	*	*	*
74S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
78S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90S	0	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 2--Continued

	90E	95E	100E	105E	110E	115E	120E	125E	130E	135E	140E	145E	150E	155E	160E	165E	170E	175E
90N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
86N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
82N	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2	271.2
78N	271.3	271.5	*	-1.4	271.5	271.3	271.3	271.4	271.3	271.2	271.2	271.2	271.2	271.5	271.2	271.2	271.2	271.2
74N	-1.4	*	*	*	*	*	0.7	0.4	-0.2	-0.9	-0.9	-1.0	-1.2	*	*	*	*	*
70N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
66N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
62N	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
58N	*	*	*	*	*	*	*	*	*	*	*	11.8	10.9	10.9	11.0	10.9	9.8	8.8
54N	*	*	*	*	*	*	*	*	*	*	*	12.3	11.8	9.2	10.9	10.7	10.0	9.4
50N	*	*	*	*	*	*	*	*	*	*	13.3	12.9	10.7	12.0	13.5	11.1	10.6	9.9
46N	*	*	*	*	*	*	*	*	*	*	18.4	14.1	10.9	18.8	18.5	13.6	13.1	10.7
42N	*	*	*	*	*	*	*	*	21.5	24.9	21.2	18.1	18.6	18.8	18.4	18.4	16.3	13.5
38N	*	27.9	*	*	*	*	*	24.0	24.3	*	27.0	24.3	24.3	23.7	23.4	23.1	23.0	18.4
34N	*	27.8	28.2	28.6	*	*	*	26.3	26.5	28.1	28.0	27.1	27.6	26.4	26.1	25.6	25.5	22.9
30N	*	27.9	28.3	28.6	28.6	28.0	28.6	27.6	28.0	28.6	28.0	27.7	27.3	27.5	27.4	17.3	27.0	25.2
26N	*	27.9	*	28.3	28.7	28.5	28.8	28.5	28.5	29.1	28.5	28.3	28.3	28.3	28.2	28.1	28.0	26.7
22N	28.2	28.0	27.9	*	27.9	28.6	27.9	28.9	29.0	29.4	29.2	29.2	28.9	28.9	28.8	28.7	28.6	27.8
18N	28.4	27.5	27.4	27.0	26.9	26.5	27.0	29.1	29.3	29.7	29.5	29.7	29.3	29.3	29.3	29.2	29.1	28.3
14N	27.9	26.5	26.5	26.0	25.9	25.1	26.4	28.9	29.4	29.8	29.8	29.8	29.4	29.4	29.4	29.4	29.2	28.7
10N	27.6	25.2	25.1	24.9	25.2	25.0	25.8	26.0	25.9	29.1	30.0	29.7	29.9	30.1	29.7	29.5	29.0	28.7
6N	27.8	22.6	22.8	23.1	24.9	23.7	25.1	26.0	25.8	26.1	29.4	29.6	30.2	30.2	30.0	29.7	29.4	28.5
2N	28.0	20.4	20.7	21.1	23.5	*	23.6	24.7	*	25.5	28.7	29.2	29.6	29.6	29.6	29.6	29.4	28.9
2S	27.3	18.4	18.7	19.1	21.6	*	*	*	*	*	25.1	25.3	26.3	26.8	26.9	29.5	29.3	29.5
6S	26.2	15.6	16.0	16.8	19.8	15.8	*	*	*	26.1	23.6	23.7	26.2	26.0	26.9	29.3	29.3	29.3
10S	24.9	13.1	13.3	14.1	17.8	12.6	*	*	*	25.5	*	*	26.5	25.1	27.3	27.7	28.1	28.3
14S	22.5	11.3	11.4	11.7	15.1	9.9	12.6	14.2	13.9	12.2	12.6	25.3	24.5	23.4	25.5	25.7	26.0	26.4
18S	20.3	9.6	9.4	9.6	12.2	6.8	10.0	12.1	11.8	10.0	10.6	23.7	22.8	21.7	23.5	23.5	23.6	23.9
22S	18.3	6.8	6.7	6.6	9.7	2.8	9.8	9.8	9.8	*	8.8	11.1	21.2	21.6	21.6	21.4	21.4	21.5
26S	15.7	3.2	3.0	2.7	6.6	1.1	7.2	7.5	7.7	11.1	5.6	9.4	*	20.0	19.9	19.5	19.1	19.0
30S	13.1	1.1	1.1	1.1	2.6	0.5	3.1	3.4	4.0	4.8	2.2	2.7	*	18.3	16.2	17.7	17.3	17.
34S	11.4	-0.3	-0.2	-0.2	1.1	1.1	1.2	1.4	1.5	1.7	0.6	0.6	13.2	16.3	13.6	15.5	15.0	15.0
38S	9.6	271.4	271.4	271.3	0.3	0.5	0.5	0.6	0.7	0.7	0.6	0.6	11.4	13.7	11.4	13.1	13.0	13.0
42S	6.6	*	*	*	-0.3	272.0	272.0	272.0	272.0	272.0	277.	272.0	9.7	11.6	9.4	11.3	11.2	10.7
46S	3.1	*	*	*	271.8	271.4	271.4	271.4	271.4	271.4	21.	271.4	6.7	9.5	7.3	9.7	9.1	8.5
50S	1.0	*	*	*	271.4	0	*	*	*	*	*	*	3.4	7.0	4.4	7.5	7.0	6.6
54S	-0.3	*	*	*	*	*	*	*	*	*	*	*	1.0	4.0	-1.0	4.6	4.6	4.3
58S	271.4	271.4	271.4	*	*	*	*	*	*	*	*	*	272.0	1.4	271.4	2.0	2.0	2.0
62S	271.4	*	*	*	271.8	272.0	272.0	272.0	272.0	272.0	*	272.0	271.4	272.0	271.4	-0.0	0.4	0.5
66S	*	*	*	*	271.4	271.4	271.4	271.4	271.4	271.4	*	271.4	*	271.4	271.4	271.4	271.5	271.4
70S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	271.4	*	271.4	271.4
74S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	271.4
78S	*	*	*	*	*	0	*	*	*	*	*	*	*	*	*	*	*	*
82S	*	*	*	*	*													
86S	*	*	*	*	*													
90S	*	*	*	*	*													

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